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FULL-LENGTH PAPER

Synthesis of novel organosilicon compounds possessing highly substituted imidazole core catalyzed by antimony trioxide

Kazem D. Safa · Maryam Allahvirdinesbat · Hassan Namazi

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Abstract A general synthetic route for the exclusive preparation of tetrasubstituted imidazoles, possessing benzylic methyl groups has been developed using Sb_2O_3 via solvent-free, one-pot reaction conditions. Detailed results from our investigation on the bromination of the benzylic methyl groups of imidazoles are described. The products generated during this study were utilized as substrates for the synthesis of organosilicon-containing imidazoles. Synthesis of tris(triorganosilyl)methylimidazole derivatives was carried out using organolithium reagents $(RSiMe_2)_3CLi$, (R= H, Me, Ph) prepared via metalation of $(RSiMe_2)_3CH$ with lithiumdiisopropylamide or methyllithium in THF, in excellent yields. $(RSiMe_2)_3CLi$, (R= Me, Ph) were treated with formylated imidazole to afford imidazole containing 2,2-*bis*(organosilyl)ethenyl groups. 2-(4-(2,2-*bis*(trimethylsilyl) vinyl)phenyl)-1,4,5-triphenyl-1*H*-imidazole was obtained via Peterson reaction in high yield. However, compound 2-(4-(2,2-*bis*(dimethyl(phenyl)silyl)vinyl)phenyl)-1,4,5-tripheny l-1*H*-imidazole was obtained in low yield likely because of the steric hindrance of the $(PhSiMe_2)_3C$- group.

Keywords Imidazoles · Sb_2O_3 · Organosilicon · MCRs · Bromination · Lithiation

Electronic supplementary material The online version of this article (doi:10.1007/s11030-014-9551-5) contains supplementary material, which is available to authorized users.

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Introduction

Organosilicon chemistry can provide a wealth of chemical and biological diversity for drug discovery [1]. Silicon-containing analogs are generally more lipophilic than their carbon analogs. Lipophilicity can provide several physiological benefits, including an increase bioavailability and improved tissue and cell penetration. Therefore, incorporating organosilicon moieties is a strategy used to augment biological activity and reduce toxicity in a bid to enhance the therapeutic value of new drugs [2,3]. Vinylsilanes, especially 2-aryl-1,1-*bis*(silyl)alkenes, are useful reagents in organic and organometallic synthesis, because of the presence of $C(sp^2)$-Si bonds that undergo numerous transformations. Their use as precursors for the preparation of ketones and isoxazoline derivatives, as well as variety of organosilicon intermediates such as acylsilanes, epoxysilanes, 1-halosilanes, silylenol ethers, (E)-alkenylsilanes, and silylenolacetates, generates interest for their synthesis [4–9].

Cyclizations via one-pot multi-component coupling reactions (MCRs) [10] are great conduits for the preparation of heterocyclic compounds. Highly substituted imidazoles have emerged as an integral part of many biological systems (viz., histidine, histamine, and biotin). They have also been found valuable as fungicides, herbicides, plant growth regulators, tranquilizer, antitumor, anti-inflammatory, anticonvulsant, antiarthritic, antiallergic, analgesic, anti-HIV, and antibacterial agents [11–17]. All of this has generated high interest from synthetic organic/medicinal chemists to develop synthetic methodologies to access this heterocyclic scaffold exemplified by the strategies shown in Fig. 1. The reported synthesis of 1,2,4,5 tetrasubstituted imidazoles involves the reaction of a 1,2-dicarbonyl **1′a**, α- hydroxyl **2′a**/acetoxy **1′b**/silyloxyketone **2′b** or 1,2-ketomonoxime **1′c**, an aldehyde **3′**, an amine, and ammonium acetate (as ammonia

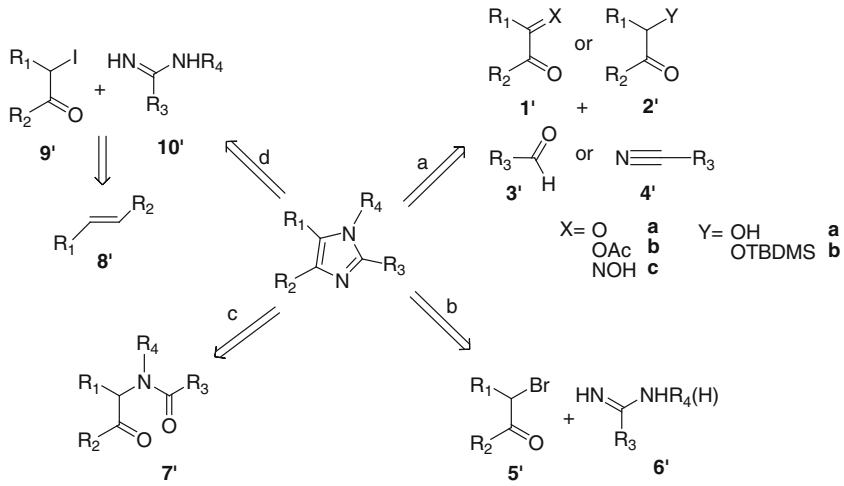


Fig. 1 Synthesis strategies for the construction of 1,2,4,5-tetrasubstituted imidazoles

source) (Fig. 1a) carried out under (i) microwave irradiation conditions in the presence of silica gel/zeolite HY or silica gel-$NaHSO_4$, and (ii) traditional heating under reflux in suitable solvents or under solvent-free condition at 140 °C in the presence of catalysts. Alternative synthetic approaches include the reaction of an α-bromoketone **5′** with substituted amidines **6′** to afford 2,4,5-trisubstituted and 1,2,4,5-tetrasubstituted imidazoles (Fig. 1b) or the cyclocondensation of *N*-alkyl-α acetamidoketone/alcohol **7′** with ammonium acetate in acetic acid or with ammonium trifluoroacetate (as solvent) under reflux conditions to generate 1,2,4,5-tetrasubstituted imidazoles (Fig. 1c). Recently, the synthesis of 1,2,4,5-tetrasubstituted imidazoles was achieved using alkenes **8′** via a 2-step ketoiodination/cyclisation strategy (Fig. 1d) [18].

These methods have their own merits and drawbacks. Some of them use hazardous, toxic, and expensive reagents, giving side reactions, requiring complex work-up and purification procedures, needing strong acidic conditions, low yields, using of moisture-sensitive reagents/catalysts, requiring to synthesize starting materials, the use of auxiliary reagents, and expensive apparatus [11,12,18]. Therefore, to avoid these limitations, we report herein the development of Sb_2O_3 catalytic systems for the convenient and efficient synthesis of 1,2,4,5-tetrasubstituted imidazoles using a 4-MCR strategy. In continuation of our interest in the synthesis of useful heterocyclic compounds possessing an imidazole core and organosilicon moieties, we have synthesized a series of new, highly substituted imidazoles containing organosilylvinyl substituent and bulky organosilicon groups using $(RSiMe_2)_3CLi$ (R=H, Me, Ph).

Results and discussion

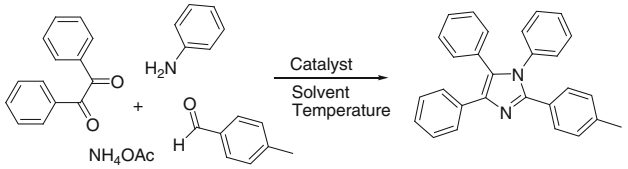
We began investigating the influence of different reaction media, amounts of catalyst, and reaction temperatures using the following as a model reaction: 4-methylbenzaldehyde (1 mmol), benzil (1 mmol), aniline (1 mmol) and ammonium acetate (1.1mmol) in the presence of a number of catalysts (Table 1). We found that the reaction performed best using Sb_2O_3 under solvent-free conditions. In addition, no conversion to product was observed in the absence of catalyst, even after 8.0 h under solvent-free conditions. Compared with the reaction carried out using other catalysts, the best results were obtained when using 10 mol% Sb_2O_3 at 110 °C for 2 h (Table 1, entry 13).

The scope of the reaction using Sb_2O_3 (10 mol%) at 110 °C under solvent-free conditions was explored using a variety of aromatic aldehydes and aniline derivatives, benzil and ammonium acetate (as ammonia source) between 1-3 h. We successfully obtained 1,2,4,5-tetrasubstituted imidazoles possessing benzylic methyl group(s) in good yields.

A plausible mechanism for the catalytic participation of Sb_2O_3 in the synthesis of tetrasubstituted imidazoles is postulated in Scheme 1. Herein, Sb_2O_3 coordinates with and activates the carbonyl group of an aldehyde to facilitate the formation of diamine intermediate **A**. Sb_2O_3 also activates the diketone to facilitate the condensation with intermediate **A** to give imidazol-5-ol intermediate **C** which, upon elimination of water, transformed into the desired 1,2,4,5-tetrasubstituted imidazoles.

In our efforts to exemplify the usefulness of the compounds generated during this study, we used compounds **1a**–**1h** to prepare highly substituted imidazoles bearing bulky organosilicon groups and vinylbis(silanes). We recently reported the preparation and reactions of related compounds containing organosilicon moieties [4,5,7,9]. We proceeded with the bromination of the benzylic methyl group(s) in compounds **1a**–**1h**. Initial efforts to brominate the benzylic methyl group in imidazole derivatives **1b**, and **1h** and **1g** did not yield expected products. Even after 4 days of reaction time only low yields were obtained. Bromination of imidazole derivatives **1a**, and **1c**–**1f** was achieved using NBS in CCl_4 in the presence of a catalytic amount of α,α′-

Table 1 Optimization of reaction conditions

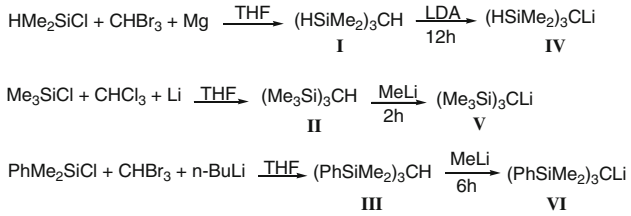


Entry	Catalyst/mol (%)	*T* (°C)	Time (h)	Yield (%)[a]
1	$AlCl_3$(10)	110	2	39
2	$SnCl_2.2H_2O$(10)	110	3	40
3	H_3BO_3(10)	110	2	43
4	$SbCl_3$(10)	110	4	30
5	$SbCl_5$(10)	110	4	32
6	Sb_2O_3(3)	110	2	56
7	Sb_2O_3(5)	110	2	65
8	Sb_2O_3 (10)	Reflux	2	51
9	Sb_2O_3(10)	Reflux	2	66
10	Sb_2O_3(10)	Reflux	3	64
11	Sb_2O_3(10)	Reflux	3	55
12	Sb_2O_3(10)	90	2	70
13	Sb_2O_3(10)	110	2	93
14	–	110	8	Trace

Reaction conditions 4-methylbenzaldehyde (1.0 mmol), benzil (1.0 mmol), aniline (1.0 mmol), ammonium acetate (1.1 mmol), and 10 mol% Sb_2O_3 at 110 °C, the solvents for entries 8-11 are MeOH, EtOH, MeCN, and EtOAc respectively

[a] Isolated yields

azobisisobutyronitrile (AIBN) at 50–52 °C. While bromo derivatives **2a**, and **2c**–**2f** were obtained in 48 h in good yields, **2g** was obtained from 1g needing 2 eq. of NBS. The crude products were used directly for the synthesis of multisubstituted imidazoles containing bulky organosilicon groups **3, 4,** and **5** via nucleophilic attack with various tris(organosilyl)methylmetals, **IV**–**VI**, in short reaction times with excellent yields. Starting materials **I**–**III** and **IV**–**VI** were synthesized using published methodologies [4–7,19–22] (see Scheme 2).



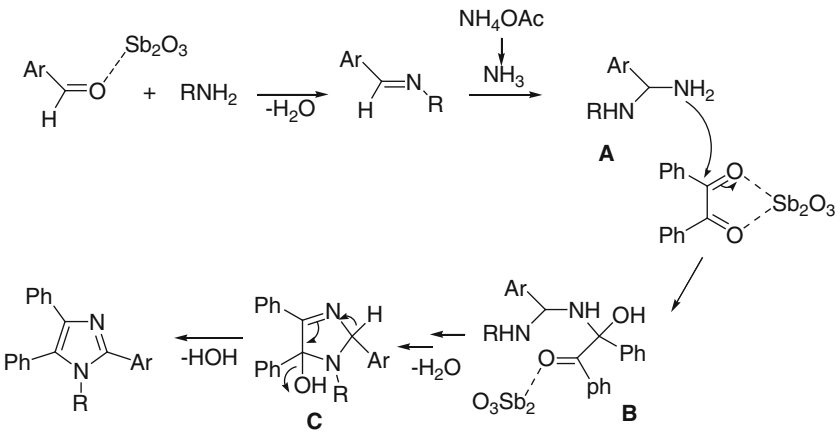
Scheme 2 Preparation of tris(organosilyl)methylmetals reagents

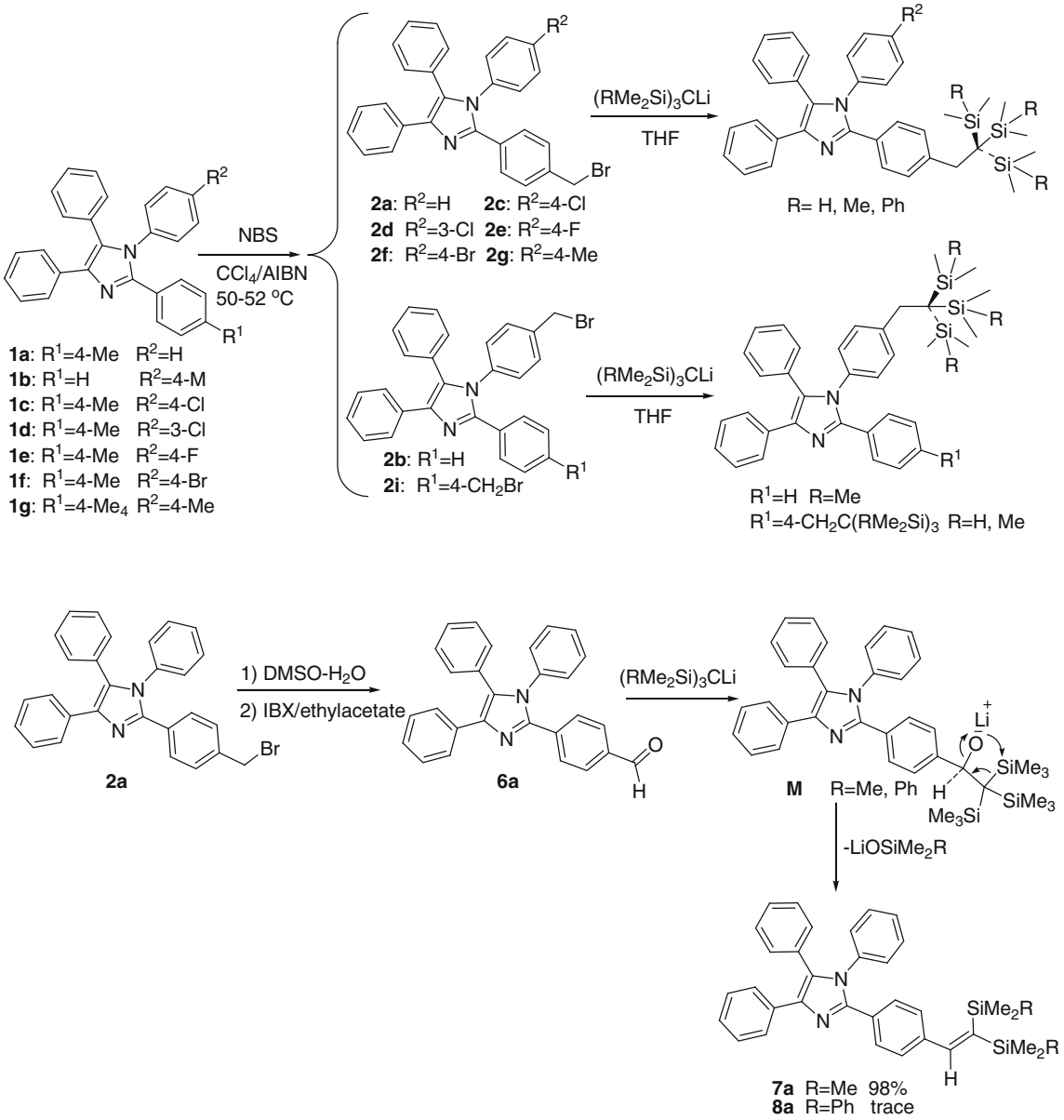
The rate of nucleophilic attack of **IV**–**VI** on the bromomethyl derivatives **2a**–**2i** decreased by increasing the steric hindrance of the R groups [4]. For the synthesis of other organosilicon-containing imidazole derivatives, **V**, **VI** were treated with formylated imidazole **6a** to afford imidazole containing 2,2-*bis*(organosilyl)ethenyl groups. For this purpose, hydrolysis of **2a** was accomplished in the presence of DMSO-H_2O. Subsequent oxidation of the resulting mixture with IBX furnished the corresponding aldehyde **6a** in excellent yield (Scheme 3). 2-(4-(2,2-*bis*(trimethylsilyl)vinyl) phenyl)-1,4,5-triphenyl-1*H*-imidazole **7a** was synthesized by the reaction of tris(trimethylsilyl)methyllithium with carbonyl moiety using a Peterson olefination approach where intermediate **M** undergoes reactions breaking and creating new bonds and the elimination of RMe_2SiOLi giving **6a** [4,22–24]. In contrast, for phenyl-containing compound **8a** only traces were detected (Scheme 3; Table 2).

Conclusion

In summary, we have established an optimized procedure for the exclusive synthesis of highly substituted imidazoles possessing benzylic methyl group(s) **1a**–**1h** via one-pot 4-component coupling cyclization reaction catalyzed by Sb_2O_3 under solvent-free condition at 110 °C in excellent yields. The formyl derivative **6a** and bromo-imidazole derivatives **2a**–**2i** were found to be excellent substrates for the synthesis of organosilicon-containing imidazoles. Highly substituted imidazoles bearing bulky organosilicon groups **3**, **4**, and **5**

Scheme 1 Plausible mechanism for the formation of 1,2,4,5-tetrasubstituted imidazoles in the presence of Sb_2O_3





Scheme 3 Synthesis of organosilicon-containing imidazoles

(Table 3) were obtained in excellent yields. It is worth noting that compounds **3a**, **3b**, **3g**, and **3i** are potential cores for dendrimers, which we will investigate and report about in future communications.

Experimental

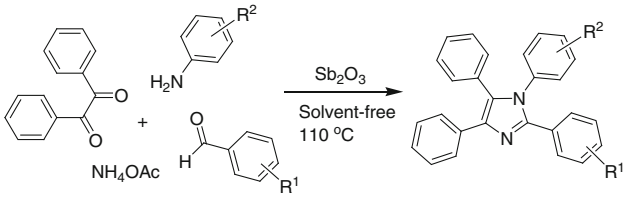
Chemicals and apparatus

Chemicals were either prepared in our laboratory or purchased from Merck, Fluka and Aldrich. Commercial products were used without further purification. ^{1}H NMR and ^{13}C NMR spectra were recorded on a Bruker FT-400 MHz spectrometer at room temperature and using $CDCl_3$ as internal standard and solvent. Abbreviations used for NMR signals are: s = singlet, d = doublet, t = triplet, and m = multiplet. FTIR spectra were recorded on a Bruker Tensor 270 spectrometer. Elemental analyses were carried out on an Elementar Vario EL III instrument. Melting points were recorded on a Büchi B-545 apparatus in open capillary tubes and are uncorrected.

Preparation of o-iodoxybenzoic acid (IBX)

Synthesized by oxidation of 2-iodobenzoic acid using $KBrO_3$ and the residue IBA was recovered to IBX according to the literature [25,26].

Table 2 Synthesis of highly substituted imidazoles



Entry	R^1	R^2	Product	Yield[a] (%)	Mp[b] (°C)	Mp[c] (°C)
a	4-Me	H	**1a**	93	182–184[27]	183–185
b	H	4-Me	**1b**	91	183–185[28]	183–184
c	4-Me	4-Cl	**1c**	86	167–169[29]	166–168
d	4-Me	3-Cl	**1d**	89	–	198–200
e	4-Me	4-F	**1e**	85	–	188–190
f	4-Me	4-Br	**1f**	88	–	190–192
g	4-Me	4-Me	**1g**	90	188–191[29]	189–191
h	4-Cl	4-Me	**1h**	92	–	167–169

[a] Isolated yields
[b] Previously reported melting point
[c] Observed melting point

Preparation of tris(dimethylsilyl)methyllithium IV [6]

A 50 mL round-bottom flask equipped with a stirrer, septum, and gas-inlet needle was charged with diisopropylamine (0.53 g, 5.3 mmol) and 15 mL of THF. The flask was placed in a water–ice bath, and then n-BuLi (3.8 mL, 1.5 M solution in hexane) was added drop-wise under magnetic stirring to form a clear yellow solution. This solution was stirred for an additional 30 min. A lithium diisopropylamide (LDA) solution was transferred into a dropping funnel, and the content was added drop-wise to a 50 mL round-bottom flask containing tris(dimethylsilyl)methane (1.0 g, 5.3 mmol) in 10 mL of THF under argon atmosphere at room temperature. The orange–red solution was stirred at ambient temperature for 10 h.

Preparation of tris(trimethylsilyl)methyllithium **V**

The reagent was prepared as described by Gröbel and coworkers [20].

Preparation of tris(dimethylphenylsilyl)methyllithium **VI**

The method for the preparation of tris(trimethylsilyl)methyl lithium was used.

General procedure for preparation of 1,2,4,5-tetrasubstituted imidazoles (**1a**–**1h**)

10 mol% Sb_2O_3 was added to the mixture of benzil (1 mmol), aldehyde (1 mmol), amine (1 mmol), and ammonium acetate (1.1 mmol). Then the reaction mixture was stirred on a preheated oil bath at 110 °C. After completion of the reaction (monitored by TLC, within 1–3 h), the crude residue was allowed to cool to room temperature. The mixture was extracted with CH_2Cl_2 (3 × 20 mL). The combined organic layers were dried over anhydrous Na_2SO_4, filtered, and the solvent evaporated to give the desired crude product. This product was washed with n-hexane and purified by recrystallization from CH_2Cl_2. The spectral data of selected products (**1d**–**1f**, **1h**) are given below.

1-(3-Chlorophenyl)-4,5-diphenyl-2-p-tolyl-1H-imidazole **1d**

White powder (89 %), M.P. = 198–200 °C, ν_{max} (KBr) 3056, 2963, 2909, 1490, 1479, 1265, 823, 739, 703 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 2.33 (s, 3H, CH3), 6.93–6.95 (m, 1H, ArH), 7.05 (t, J = 1.86Hz, 1H, ArH), 7.08 (d, 2H, J = 8.04 Hz, ArH), 7.12–7.27 (m, 10H, ArH), 7.32 (d, 2H, J = 8.15 Hz, ArH),7.58–7.60 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 20.27, 125.64, 125.77, 126.24, 126.33, 127.14, 127.15, 127.47, 127.58, 127.78, 127.95, 128.92, 129.31, 130.05, 133.21, 133.48, 137.33, 137.45, 146.00. Anal.Calcd for $C_{28}H_{21}ClN_2$: C, 79.89; H, 5.03; N, 6.66 %. *Found*: C, 79.78; H, 5.12; N, 6.74 %.

1-(4-Fluorophenyl)-4,5-diphenyl-2-p-tolyl-1H-imidazole **1e**

White powder (85 %), M.P. = 188–190 °C, ν_{max} (KBr) 3058, 2962, 2908, 1602, 1508, 1444, 1418, 1312, 1225, 960, 775, 730 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 2.36 (s, 3H, CH3), 6.96–7.00 (m, 2H, ArH), 7.03–7.07 (m, 2H,

Table 3 Preparation of imidazoles containing bulky organosilicon groups

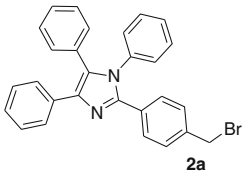
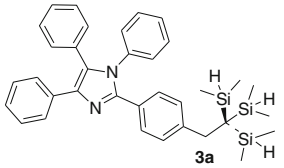
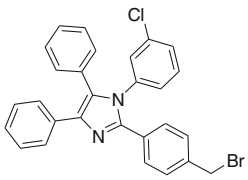
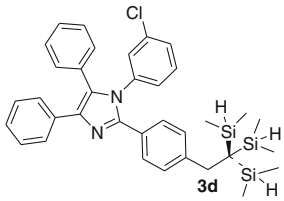
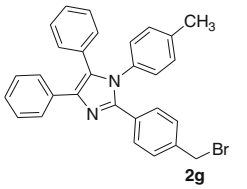
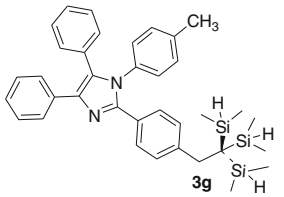
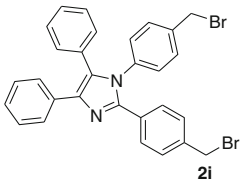
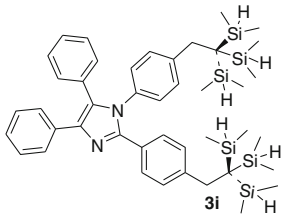
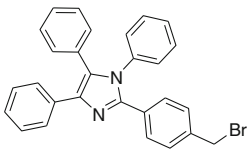
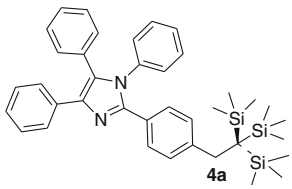
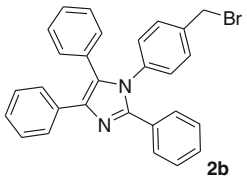
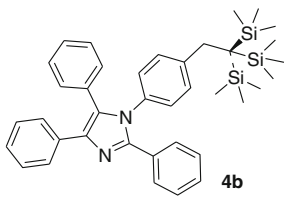
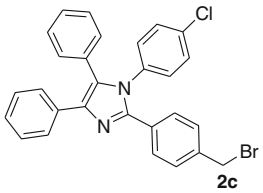
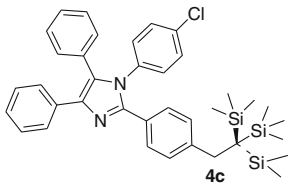
Entry	Substrate **2a**-**2i**	$(R_3Si)_3CLi$	Product **3**-**5**	Time (min)	Yield[a] (%)
1	 **2a**	$(HSiMe_2)_3CLi$	 **3a**	3	93
2	 **2d**	$(HSiMe_2)_3CLi$	 **3d**	3	92
3	 **2g**	$(HSiMe_2)_3CLi$	 **3g**	3	92
4	 **2i**	$(HSiMe_2)_3CLi$	 **3i**	3	91
5	 **2a**	$(Me_3Si)_3CLi$	 **4a**	5	90
6	 **2b**	$(Me_3Si)_3CLi$	 **4b**	5	91
7	 **2c**	$(Me_3Si)_3CLi$	 **4c**	5	92

Table 3 continued

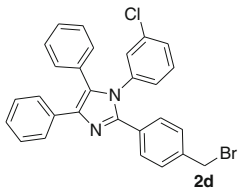
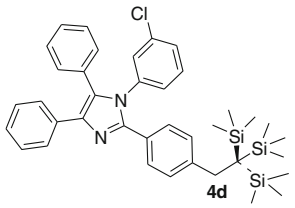
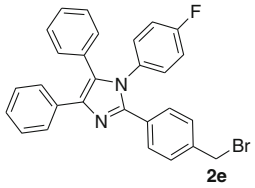
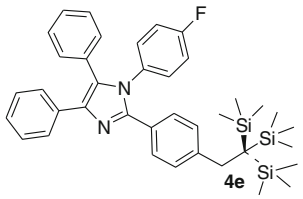
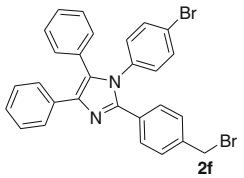
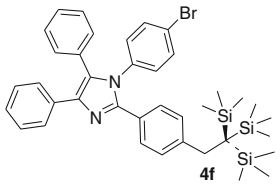
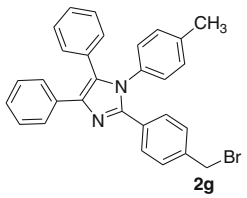
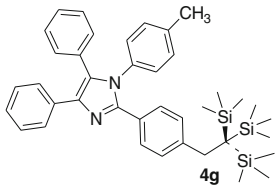
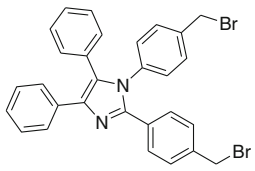
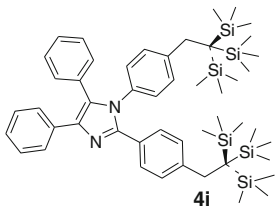
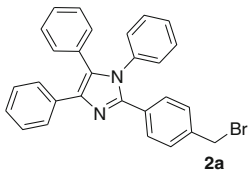
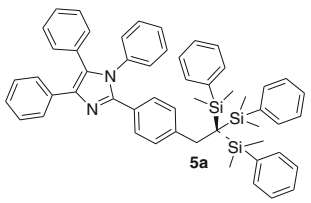
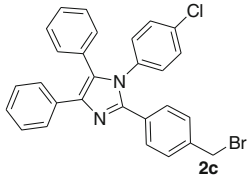
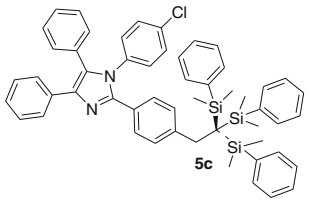
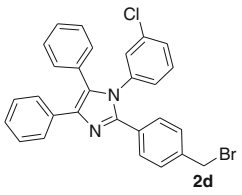
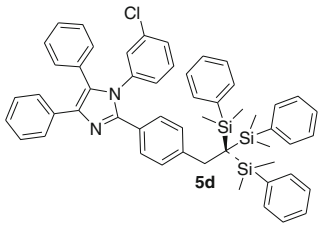
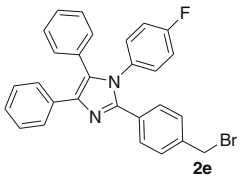
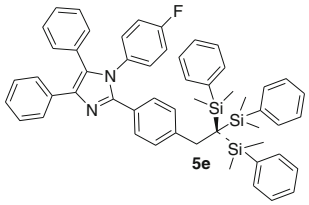
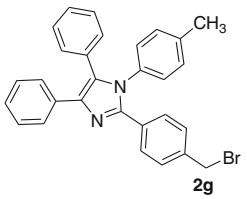
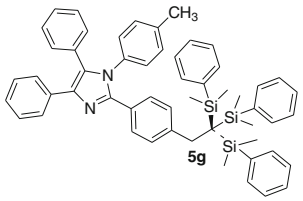
Entry	Substrate **2a**-**2i**	$(R_3Si)_3CLi$	Product **3**-**5**	Time (min)	Yield[a] (%)
8	 **2d**	$(Me_3Si)_3CLi$	 **4d**	5	90
9	 **2e**	$(Me_3Si)_3CLi$	 **4e**	5	91
10	 **2f**	$(Me_3Si)_3CLi$	 **4f**	5	92
11	 **2g**	$(Me_3Si)_3CLi$	 **4g**	5	91
12	 **2i**	$(Me_3Si)_3CLi$	 **4i**	5	89
13	 **2a**	$(PhMe_2Si)_3CLi$	 **5a**	15	88
14	 **2c**	$(PhMe_2Si)_3CLi$	 **5c**	15	87

Table 3 continued

Entry	Substrate **2a**-**2i**	$(R_3Si)_3CLi$	Product **3**-**5**	Time (min)	Yield[a] (%)
15	 **2d**	$(PhMe_2Si)_3CLi$	 **5d**	15	89
16	 **2e**	$(PhMe_2Si)_3CLi$	 **5e**	15	85
17	 **2g**	$(PhMe_2Si)_3CLi$	 **5g**	15	87

[a] Isolated yields

ArH), 7.11 (d, 2H, J = 8.0 Hz, ArH), 7.14–7.17 (m, 2H, ArH), 7.21–7.32 (m, 6H, ArH). 7.35 (d, 2H, J = 8.0 Hz, ArH), 7.63 (d, 2H, J = 7.2 Hz, ArH), ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 20.24, 114.95, 115.17, 125.58, 126.32, 126.41, 127.01, 127.12, 127.41, 127.79, 127.88, 128.99, 129.08, 129.50, 129.58, 130.07, 132.19, 133.30, 137.16, 137.31, 146.12, 159.59, 162.06. Anal.Calcd for $C_{28}H_{21}FN_2$: C, 83.14; H, 5.23; N, 6.93 %. *Found*: C, 83.09; H, 5.14; N, 6.81 %.

1-(4-Bromophenyl)-4,5-diphenyl-2-p-tolyl-1H-imidazole **1f**

White powder (88 %), M.P. = 190–192 °C, ν_{max} (KBr) 3445, 3057, 2961, 2908, 1570, 1510, 1478, 1312, 1267, 833, 726, 697 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 2.36 (s, 3H, CH3), 6.93 (d, J = 8.6 Hz, 2H, ArH), 7.11–7.17 (m, 4H, ArH), 7.20–7.35 (m, 8H, ArH), 7.41 (d, 2H, J = 8.6 Hz, ArH), 7.60–7.62 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 20.27, 121.06, 121.58, 125.64, 126.37, 127.14, 127.51, 127.88, 127.96, 128.56, 128.91, 129.35, 129.44, 130.10, 131.13, 131.25, 133.27, 135.27, 137.42, 146.04. Anal.Calcd for $C_{28}H_{21}BrN_2$: C, 72.26; H, 4.55; N, 6.02 %. *Found*: C, 72.14; H, 4.47; N, 6.14 %.

2-(4-Chlorophenyl)-4,5-diphenyl-1-p-tolyl-1H-imidazole **1h**

White powder (92 %), M.P. = 167–169 °C, ν_{max} (KBr) 3054, 2976, 1510, 1478, 1445, 1312, 1266, 832, 745, 696 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 2.36 (s, 3H, CH3), 6.95 (d, J = 8.1 Hz, 2H, ArH), 7.10 (d, J = 8.1 Hz, 2H, ArH), 7.16–7.18 (m, 2H, ArH), 7.21–7.30 (m, 8H, ArH), 7.41–7.43 (m, 2H, ArH), 7.61–7.63 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 20.14, 119.77, 125.61, 126.30, 126.95, 126.99, 127.13, 127.29, 127.31, 128.10, 128.82, 129.03, 129.50, 130.05, 130.17, 133.15, 133.21, 133.31, 137.41, 144.74. Anal.Calcd for $C_{28}H_{21}ClN_2$: C, 79.89; H, 5.03; N, 6.66 %. *Found*: C, 79.76; H, 5.14; N, 6.86 %.

General procedure for bromination of imidazole derivatives

Compounds **2a**–**2h** were prepared by reacting compounds **1a**–**1h** (1 mmol) with *N*-bromosuccinimide (NBS) (1 mmol), and compound **2i** was obtained by reacting compound **1g** (1 mmol) with NBS (2 mmol) in 70 mL of carbon tetrachloride under an argon atmosphere. To initiate the reaction, 10 mol% of α, α′-azobisisobutyronitrile (AIBN) was added and the reaction mixture was stirred at 50–52 °C. The

optimum reaction time for **2a**, and **2c**–**2g** was 2 days while that for **2b**, **2h**, and **2i** was observed to be 4 days. Then the reaction mixture was cooled to 10 °C, and the precipitated succinimide was filtered off. The solution was washed with water three times, the organic phase dried over Na_2SO_4, and the solvent evaporated under vacuum. Crude products **2a** and **2e** were purified by column chromatography (silica gel, hexane/ethylacetate mixture (10:1, v/v)) to afford bromomethyl imidazoles **2a** and **2e**.

2-(4-(Bromomethyl)phenyl)-1,4,5-triphenyl-1H-imidazole **2a**

White powder (75 %), M.P. = 160–162 °C, ν_{max} (KBr) 3058, 2922, 1600, 1495, 1446, 1384, 1228, 764, 736, 697, 534 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 4.45 (s, 2H, CH_2), 7.04-7.06 (m, 2H, Ar-H), 7.11–7.13 (m, 2H, Ar-H), 7.18–7.33 (m, 11H, Ar-H), 7.41 (d, J = 8.2 Hz, 2H, Ar-H), 7.58 (d, J = 7.2 Hz, 2H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 32.11, 125.65, 126.34, 126.40, 127.00, 127.15, 127.27, 127.32, 127.36, 127.41, 127.79, 127.83, 128.00, 128.07, 128.16, 130.05, 135.94, 136.52, 145.10. Anal.Calcd for $C_{28}H_{21}BrN_2$: C, 72.26; H, 4.55; N, 6.02 %. *Found*: C, 72.21; H, 4.59; N, 6.24 %.

2-(4-(Bromomethyl)phenyl)-1-(4-fluorophenyl)-4,5-diphenyl-1H-imidazole **2e**

White powder (73 %), M.P. = 152–154 °C, ν_{max} (KBr) 3058, 1603, 1509, 1446, 1225, 825, 777, 733, 698, 532 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 4.49 (s, 2H), 6.99–7.09 (m, 4H, Ar-H), 7.16 (dd, J = 1.6 Hz, J = 7.8 Hz, 2H, Ar-H), 7.24–7.34 (m, 8H, Ar-H), 7.44 (d, J = 8.3 Hz, 2H, Ar-H), 7.60–7.63 (m, 2H, Ar-H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 31.98, 115.165, 115.39, 125.77, 126.32, 127.19, 127.48, 127.94, 128.01, 128.12, 128.99, 129.07, 129.22, 130.05, 131.95, 133.03, 136.78, 159.75, 162.23. Anal.Calcd for $C_{28}H_{20}BrFN_2$: C, 69.57; H, 4.17; N, 5.80 %. *Found*: C, 69.45; H, 4.09; N, 5.72 %.

Preparation of 4-(1,4,5-triphenyl-1*H*-imidazol-2-yl) benzaldehyde **6a**

A mixture of bromo-imidazole **2a** and starting material **1a** was taken up in DMSO/H_2O (100 mL, 90:10, v/v) and stirred at 80 °C. After completion of the reaction (monitored by TLC, within 3–6 h), the reaction mixture was quenched with excess of cold water (150 mL), extracted with ethylacetate (2 × 20 mL), and dried (Na_2SO_4), the organic phase was evaporated under reduced pressure. To crude product of appropriate alcohol, was added *o*-iodoxybenzoic acid (IBX) (1.2 mmol) and the resulting mixture was stirred at 80 °C for 4 h. Then the residue was subjected to column chromatography over silica gel using (8:2, v/v) hexane/ethylacetate mixture as eluent to give unreacted starting material **1a**. Further elution with (1:1, v/v) hexane/ethylacetate furnished the aldehyde **6a**.

White powder (97 %), M.P. = 157–159 °C, ν_{max} (KBr) 3068, 2962, 2933, 2872, 2734, 1691, 1599, 1507, 1475, 1411, 1255, 1093, 831, 747, 648 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 7.07 (dd, J = 1.5 Hz, J = 8.0 Hz, 2H, ArH), 7.13 (dd, J = 1.5 Hz, J = 8.0 Hz, 2H, ArH), 7.22–7.32 (m, 9H, ArH), 7.42 (d, J = 8.6 Hz, 2H, ArH), 7.46–7.48 (m, 2H, ArH), 7.58–7.60 (m, 2H, ArH), 9.51 (s, 1H, HC=O). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 125.77, 126.31, 126.37, 126.95, 127.03, 127.11, 127.20, 127.36, 127.38, 127.56, 128.13, 128.26, 129.31, 130.06, 131.36, 135.94, 141.66, 190.04. Anal.Calcd for $C_{28}H_{20}N_2O$: C, 83.98; H, 5.03; N, 7.00 %. *Found*: C, 83.85; H, 4.99; N, 7.12 %.

General procedure for the synthesis of 2-(4-(2,2-bis(triorganosilyl)vinyl)phenyl)-1,4,5-triphenyl-1*H*-imidazoles

To a stirred solution of **VI** or **V**and/or **VI** (5.3 mmol) in THF at room temperature was added aldehyde **6a** (5.0 mmol) in 10 mL THF, and then stirred for 3–5 min at room temperature. The reaction mixture was poured onto an aqueous ammonium chloride solution (50 mL) and extracted with CH_2Cl_2 (2 × 50 mL). The organic phase was washed with water (100 mL), dried (Na_2SO_4), and the solvent was removed to yield desired product as a white solid.

2-(4-(2,2-Bis(trimethylsilyl)vinyl)phenyl)-1,4,5-triphenyl-1H-imidazole **7a**

White powder (98 %), M.P. = 120–122 °C, ν_{max} (KBr) 3386, 3031, 2959, 1648, 1605, 1501, 1410, 1244, 836 (Si–CH3), 764, 686 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) −0.08 (s, 9H, $SiMe_3$), 0.17 (s, 9H, $SiMe_3$), 7.01 (dd, J = 1.6 Hz, J = 8.0 Hz, 2H, ArH), 7.05 (d, 2H, J = 8.1 Hz, ArH), 7.13 (dd, J = 1.6 Hz, J = 8.00 Hz, 2H, ArH), 7.19–7.27 (m, 9H, ArH), 7.34 (d, 2H, J = 8.1 Hz, ArH), 7.60 (dd, J = 1.2 Hz, J = 8.4 Hz, 2H, ArH), 7.69 (s, 1H, HC=). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) -0.53 ($SiMe_3$), 1.01 ($SiMe_3$), 125.57, 126.28, 126.43, 126.55, 126.92, 127.14, 127.31, 127.40, 127.42, 127.53, 128.02, 129.58, 129.76, 130.08, 133.40, 136.04, 141.68, 145.84, 146.26, 153.15. Anal.Calcd for $C_{35}H_{38}N_2Si_2$: C, 77.44; H, 7.06; N, 5.16 %. *Found*: C, 77.48; H, 7.16; N, 5.10 %.

Tris(dimethylphenylsilyl)methyllithium did not react with **6a** under reflux conditions in THF for 3 h.

Preparation of imidazoles containing bulky organosilicon groups $(RSiMe_2)_3C$- (R= H, Me, Ph)

To a stirred solution of **VI** or**V**and/or **VI** (5 mmol) in THF was added a mixture of **2a**–**2g** (5 mmol) in 10 mL THF and or (2.5 mmol) of **2i** in THF at room temperature. The mixture was stirred for another 10 min at room temperature. The mixture was poured onto an ammonium chloride aqueous (50 mL) and extracted with CH_2Cl_2 (2×20 mL). The organic phase was washed with water (100 mL), dried (Na_2SO_4), and the solvent removed in vacuum to yield a yellow solid.

Selected spectral data of the products

*2-(4-(2,2,2-Tris(dimethylsilyl)ethyl)phenyl)-1,4,5-triphenyl-1H-imidazole (***3a***)*

White powder (93 %), M.P. = 140–142 °C, ν_{max} (KBr) 3419, 3060, 2956, 2902, 2112 (Si–H), 1599, 1496, 1445, 1419, 1390, 1254, 960, 836 (Si–CH_3), 765, 695 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.1–0.11 (d, 18H, $SiMe_2$), 3.00 (s, 2H, CH_2), 4.03–4.04 (m, 3H, Si–H), 7.00 (d, J = 7.3 Hz, 2H, ArH), 7.11–7.31 (m, 15H, ArH)), 7.59 (d, 2H, J = 7.3 Hz, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) -4.09 ($SiMe_2$), 3.41 ($C(SiMe_2)_3$), 34.71 (CH_2), 125.55, 126.47, 126.87, 127.08, 127.11, 127.28, 127.38, 127.50, 127.97, 129.16, 129.59, 129.61, 130.08, 133.37, 136.00, 137.17, 139.78, 145.96. Anal.Calcd for $C_{35}H_{42}N_2Si_3$: C, 73.11; H, 7.36; N, 4.87 %. *Found*: C, 73.23; H, 7.32; N, 4.69 %.

*2-(4-(2,2,2-Tris(dimethylsilyl)ethyl)phenyl)-1-(3-chloro phenyl)-4,5-diphenyl-1H-imidazole (***3d***)*

White powder (92 %), M.P. = 132–134 °C, ν_{max} (KBr) 3062, 2958, 2925, 2113 (Si–H), 1590, 1479, 1445, 1420,1256, 961, 835 (Si-CH_3), 693 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.10–0.11 (d, 18H, $SiMe_2$), 3.01 (s, 2H, CH_2), 4.01–4.05 (m, 3H, Si–H), 6.89–6.92 (m, 1H, ArH), 7.02 (t, J = 1.9 Hz, 1H, ArH), 7.11–7.31 (m, 14H, ArH), 7.57–7.60 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) −4.09 ($SiMe_2$), 3.40 ($C(SiMe_2)_3$), 34.76 (CH_2), 125.67, 125.73, 126.39, 127.04, 127.15, 127.43, 127.47, 127.53, 128.87, 129.25, 129.34, 129.47, 130.05, 133.18, 133.52, 137.20, 140.09, 145.91. Anal.Calcd for $C_{35}H_{41}ClN_2Si_3$: C, 68.98; H, 6.78; N, 4.60 %. *Found*: C, 68.81; H, 6.69; N, 4.61 %.

*2-(4-(2,2,2-Tris(dimethylsilyl)ethyl)phenyl)-4,5-diphenyl-1-p-tolyl-1H-imidazole (***3g***)*

White powder (92 %), M.P. = 138–140 °C, ν_{max} (KBr) 3059 (Ar–H), 2958 (C-H), 2904, 2114 (Si-H), 1601, 1512, 1450 (Ar), 1419, 1256, 835 (Si-CH_3), 802, 695 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.13–0.14 (d, 18H, $SiMe_2$), 2.34 (s, 3H, CH_3), 3.03 (s, 2H, CH_2), 4.04–4.08 (m, 3H, Si-H), 6.91 (d, J = 8.1 Hz, 2H, ArH), 7.05 (d, J = 8.1 Hz, 2H, ArH), 7.15–7.42 (m, 12H, ArH)), 7.62 (d, 2H, J = 7.3 Hz, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) −4.05 ($SiMe_2$), 3.40 ($C(SiMe_2)_3$), 20.14 (CH_3), 34.73 (CH_2), 125.46, 126.31, 126.44, 126.80, 127.10, 127.27, 127.48, 127.60, 128.60, 129.12, 129.69, 129.80, 130.12, 133.46, 133.57, 136.95, 139.69. Anal.Calcd for $C_{36}H_{44}N_2Si_3$: C, 73.41; H, 7.53; N, 4.76 %. *Found*: C, 73.21; H, 7.48; N, 4.66 %.

*1,2-Bis(4-(2,2,2-tris(dimethylsilyl)ethyl)phenyl)-4,5-diphenyl-1H-imidazole (***3i***)*

White powder (91 %), M.P. = 143–145 °C, ν_{max} (KBr) 3414, 3034, 2956, 2924, 2112 (Si–H), 1613, 1512, 1454, 1417, 1255, 960, 834 (Si–CH_3), 694 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.09–0.10 (d, 18H, $SiMe_2$), 0.10–0.11 (d, 18H, $SiMe_2$), 2.98 (s, 4H, $2 \times CH_2$), 3.99–4.05 (m, 6H, Si–H), 6.89 (d, J = 8.2 Hz, 2H, ArH), 7.09–7.24 (m, 10H, ArH), 7.27–7.38 (m, 4H, ArH)), 7.57–7.59 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) −4.09 ($SiMe_2$), −4.06 ($SiMe_2$), 3.38 ($C(SiMe_2)_3$), 34.71 (CH_2), 125.48, 126.31, 126.42, 126.64, 126.81, 127.10, 127.35, 127.39, 127.49, 129.20, 130.15, 130.2. Anal.Calcd for $C_{43}H_{64}N_2Si_6$: C, 66.43; H, 8.30; N, 3.60 %. *Found*: C, 66.41; H, 8.27; N, 3.52 %.

*2-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-1,4,5-triphenyl-1H-imidazole (***4a***)*

White powder (90 %), M.P. = 198–200 °C, ν_{max} (KBr) 3062, 2953, 1600, 1498, 1450, 1392, 1256, 937, 840 (Si–CH3), 769, 695 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.10 (s, 27H, $SiMe_3$), 3.15 (s, 2H, CH_2), 7.00 (d, J= 6.4 Hz, 2H, ArH), 7.14 (d, J = 5.0 Hz, 2H, ArH), 7.18–7.27 (m, 13H, ArH)), 7.61 (d, 2H, J = 6.8 Hz, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.44 ($SiMe_3$), 9.95 ($C(SiMe_3)_3$), 34.51 (CH_2), 125.52, 126.47, 126.86, 127.00, 127.12, 127.28, 127.42, 127.71, 127.98, 129.26, 129.60, 129.64, 130.09, 133.47, 136.03, 137.24, 141.91, 145.95. Anal.Calcd for $C_{38}H_{48}N_2Si_3$: C, 73.96; H, 7.84; N, 4.54 %. *Found*: C, 73.91; H, 7.82; N, 4.52 %.

*1-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-2,4,5-triphenyl-1H-imidazole (***4b***)*

White powder (91 %), M.P. = 168–170 °C, ν_{max} (KBr) 3442, 3059, 2953, 2901, 1509, 1478, 1445, 1390, 1256, 938, 841 (Si–CH_3), 768, 695 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.07 (s, 27H, $SiMe_3$), 3.11 (s, 2H, CH_2), 6.89 (d, J = 8.0 Hz, 2H, ArH), 7.12 (d, J = 6.4 Hz, 2H, ArH),

7.19–7.26 (m, 11H, ArH)), 7.45 (d, 2H, J = 6.7 Hz, ArH)), 7.58 (d, 2H, J = 7.4 Hz, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.49 ($SiMe_3$), 10.07 ($C(SiMe_3)_3$), 34.45 (CH_2), 125.53, 126.37, 126.62, 126.84, 126.96, 127.11, 127.17, 127.42, 127.87, 128.06, 129.50, 130.11, 130.20, 130.37, 133.33, 134.11, 137.09, 142.00. Anal.Calcd for $C_{38}H_{48}N_2Si_3$: C, 73.96; H, 7.84; N, 4.54 %. *Found*: C, 73.89; H, 7.87; N, 4.60 %.

*2-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-1-(4-chloro phenyl)-4,5-diphenyl-1H-imidazole (***4c***)*

White powder (92 %), M.P. = 181–183 °C, ν_{max} (KBr) 3426, 3060, 2956, 2900, 1603, 1493, 1448, 1258, 940, 840 (Si–CH_3), 727, 697 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.01 (s, 27H, $SiMe_3$), 3.16 (s, 2H, CH_2), 6.92 (d, 2H, J = 7.9 Hz, ArH), 7.12–7.28 (m, 14H, ArH)), 7.58 (d, J = 7.56 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.46 ($SiMe_3$), 10.12 ($C(SiMe_3)_3$), 34.56 (CH_2), 125.66, 126.44, 127.15, 127.50, 127.77, 128.25, 128.63, 129.44, 130.09, 132.94, 133.27, 134.62, 137.47, 142.24, 146.00. Anal.Calcd for $C_{38}H_{47}ClN_2Si_3$: C, 70.05; H, 7.27; N, 4.30 %. *Found*: C, 70.62; H, 7.31; N, 4.41 %.

*2-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-1-(3-chloro phenyl)-4,5-diphenyl-1H-imidazole (***4d***)*

White powder (90 %), M.P. = 116–118 °C, ν_{max} (KBr) 3446, 3064, 2953, 1417, 1412, 1254, 935, 835, 688 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.10 (s, 27H, $SiMe_3$), 3.17 (s, 2H, CH_2), 6.90 (d, J = 7.7 Hz, 1H, ArH), 7.03 (s, 1H, ArH), 7.13–7.31 (m, 14H, ArH), 7.59 (d, 2H, J = 7.3 Hz, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.43 ($SiMe_3$), 9.95 ($C(SiMe_3)_3$), 34.54 (CH_2), 124.98, 125.66, 125.79, 126.40, 127.00, 127.14, 127.39, 127.46, 127.52, 127.66, 128.87, 129.26, 129.43, 130.05, 133.20, 133.53, 137.21, 142.25, 145.86. Anal.Calcd for $C_{38}H_{47}ClN_2Si_3$: C, 70.05; H, 7.27; N, 4.30 %. *Found*: C, 70.09; H, 7.27; N, 4.31 %.

*2-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-1-(4-fluoro phenyl)-4,5-diphenyl-1H-imidazole (***4e***)*

White powder (91 %), M.P. = 188–190 °C, ν_{max} (KBr) 3443, 3064, 2925, 1560, 1506, 1448, 1251, 937, 833 (Si–CH_3), 778, 674 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.086 (s, 27H, $SiMe_3$), 3.15 (s, 2H, CH_2), 6.89–6.98 (m, 4H, ArH), 7.11 (dd, J = 1.6 Hz, J = 7.6 Hz, 2H, ArH), 7.19–7.32 (m, 10H, ArH)), 7.57–7.59 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.42 ($SiMe_3$), 10.00 ($C(SiMe_3)_3$), 34.51 (CH_2), 114.90, 115.13, 125.61, 126.41, 127.04, 127.14, 127.18, 127.42, 127.71, 129.00, 129.10, 129.37, 129.44, 129.56, 130.06, 132.10, 133.28, 137.29, 142.14, 146.03, 159.54, 162.01. Anal.Calcd for $C_{38}H_{47}FN_2Si_3$: C, 71.87; H, 7.46; N, 4.41 %. *Found*: C, 71.80; H, 7.47; N, 4.52 %.

*2-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-1-(4-bromo phenyl)-4,5-diphenyl-1H-imidazole (***4f***)*

White powder (92 %), M.P. = 179–181 °C, ν_{max} (KBr) 3060, 2954, 1605, 1489, 1446, 1390, 1257, 936, 839 (Si–CH3), 777, 737, 698 cm-1. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.08 (s, 27H, $SiMe_3$), 3.15 (s, 2H, CH_2), 6.83 (d, J = 8.6 Hz, 2H, ArH), 7.10–7.12 (dd, J = 1.7 Hz, J = 7.7Hz, 2H, ArH), 7.19–7.27 (m, 10H, ArH)), 7.33 (d, 2H, J = 8.6 Hz, ArH), 7.55–7.58 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.45 ($SiMe_3$), 10.12 ($C(SiMe_3)_3$), 34.53 (CH_2), 120.95, 125.66, 126.44, 127.13, 127.15, 127.28, 127.44, 127.52, 127.79, 128.93, 129.30, 129.35, 129.44, 130.08, 131.23, 133.24, 135.10, 137.49, 145.26. Anal.Calcd for $C_{38}H_{47}BrN_2Si_3$: C, 65.58; H, 6.81; N, 4.03 %. *Found*: C, 65.48; H, 6.79; N, 4.00 %.

*2-(4-(2,2,2-Tris(trimethylsilyl)ethyl)phenyl)-4,5-diphenyl-1-p-tolyl-1H-imidazole (***4g***)*

White powder (91 %), M.P. = 165–167 °C, ν_{max} (KBr) 3444, 3056, 2953, 1512, 1448, 1257, 939, 838 (Si–CH_3), 776, 696 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.07 (s, 27H, $SiMe_3$), 2.30 (s, 3H, CH_3), 3.13 (s, 2H, CH_2), 6.85 (d, 2H, J = 8.0 Hz, ArH), 7.00 (d, J = 8.0 Hz, 2H, ArH).7.11–7.26 (m, 12H, ArH)), 7.57 (d, J = 7.3 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.44 ($SiMe_3$), 10.05 ($C(SiMe_3)_3$), 20.09 (CH_3), 34.53 (CH_2), 125.47, 126.00, 126.31, 126.48, 126.71, 126.80, 127.10, 127.14, 127.26, 127.49, 127.73, 128.61, 128.76, 129.21, 130.12, 133.56, 136.91, 141.80. Anal.Calcd for $C_{39}H_{50}N_2Si_3$: C, 74.22; H, 7.99; N, 4.36 %. *Found*: C, 74.19; H, 7.90; N, 4.41 %.

*1,2-Bis(4-(2,2,2-tris(trimethylsilyl)ethyl)phenyl)-4,5-di phenyl-1H-imidazole (***4i***)*

White powder (89 %), M.P. = 170–172 °C, ν_{max} (KBr) 3417, 3060, 2955, 1510, 1451, 1257, 938, 838 (Si–CH3), 677 cm^{-1}. ^{1}H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.08 (s, 54H, 2 × $SiMe_3$), 3.11 (s, 2H, CH_2), 3.13 (s, 2H, CH_2), 6.84–6.86(m, 2H, ArH), 7.09–7.36 (m, 14H, ArH)), 7.58 (d, J = 7.2 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.43 ($SiMe_3$), 2.50 ($SiMe_3$), 34.45(CH_2), 34.52 (CH_2), 125.48, 126.45, 126.74, 127.06, 127.10, 127.39, 127.61, 127.66, 127.94, 128.65, 129.28, 129.59, 130.00, 130.17, 130.32, 134.26, 141.87, 141.97. Anal.Calcd for $C_{49}H_{76}N_2Si_6$: C, 68.30; H, 8.89; N, 3.25 %. *Found*: C, 68.28; H, 8.79; N, 3.34 %.

*2-(4-(2,2,2-Tris(dimethyl(phenyl)silyl)ethyl)phenyl)-1,4,5-triphenyl-1H-imidazole (***5a***)*

White powder (88 %), M.P. =220–222 °C, ν_{max} (KBr) 34119, 3065, 2959, 2922, 1598, 1494, 1450, 1253, 931, 836 (Si–CH_3), 764, 700 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.19 (s, 18H, $SiMe_3$), 3.56 (s, 2H, CH_2), 7.05 (d, 2H, J = 7.2 Hz, ArH), 7.13 (d, J = 6.2 Hz, 2H, ArH), 7.21–7.26 (m, 14H, ArH), 7.28–7.33 (m, 8H, ArH), 7.36–7.38 (m, 6H, ArH), 7.61 (d, J = 7.2 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 1.45 ($SiMe_3$), 12.68 ($C(SiMe_3)_3$), 35.32 (CH_2), 125.54, 126.24, 126.38, 126.43, 126.88, 127.12, 127.28, 127.41, 127.45, 127.67, 128.04, 129.62, 129.74, 130.08, 130.17, 133.47, 134.29, 136.13, 137.32, 139.63, 140.90, 145.74. Anal.Calcd for $C_{53}H_{54}N_2Si_3$: C, 79.25; H, 6.78; N, 3.49 %. *Found*: C, 79.15; H, 6.70; N, 3.51 %.

*2-(4-(2,2,2-Tris(dimethyl(phenyl)silyl)ethyl)phenyl)-1-(4-chlorophenyl)-4,5-diphenyl-1H-imidazole (***5c***)*

White powder (87 %), M.P. = 198–200 °C, ν_{max} (KBr) 3445, 3063, 2960, 2909, 1603, 1490, 1423, 1312, 1252, 932, 836 (Si–CH_3), 736, 701 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.22 (s, 18H, $SiMe_3$), 3.59 (s, 2H, CH_2), 6.98 (d, 2H, J = 8.3 Hz, ArH), 7.13–7.40 (m, 29H, ArH), 7.61 (d, J = 7.4 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 1.47 ($SiMe_3$), 12.76 ($C(SiMe_3)_3$), 35.37 (CH_2), 125.70, 126.19, 126.43, 126.81, 127.18, 127.39, 127.51, 127.73, 128.10, 128.31, 128.59, 129.35, 129.54, 129.86, 130.08, 130.32, 133.05, 133.24, 134.30, 134.69, 137.58, 139.62, 141.26, 145.75. Anal.Calcd for $C_{53}H_{53}ClN_2Si_3$: C, 75.99; H, 6.38; N, 3.34 %. *Found*: C, 75.96; H, 6.40; N, 3.38 %.

*2-(4-(2,2,2-Tris(dimethyl(phenyl)silyl)ethyl)phenyl)-1-(3-chlorophenyl)-4,5-diphenyl-1H-imidazole (***5d***)*

White powder (89 %), M.P. = 196–198 °C, ν_{max} (KBr) 3066, 3046, 2990, 2959, 2908, 1589, 1532, 1479, 1425, 1253, 958, 836 (Si–CH_3), 734, 698 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.3 (s, 18H, $SiMe_3$), 3.68 (s, 2H, CH_2), 7.04–7.05(m, 1H, ArH), 7.16 (t, J = 1.9 Hz, 1H, ArH), 7.20–7.24 (m, 3H, ArH), 7.29–7.42 (m, 20H, ArH), 7.46–7.48 (m, 6H, ArH), 7.69–7.71 (m, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 1.44 ($SiMe_3$), 12.58 ($C(SiMe_3)_3$), 35.33 (CH_2), 125.69, 125.75, 126.15, 126.39, 127.16, 127.26, 127.40, 127.48, 127.70, 128.96 129.18, 129.58, 130.02, 130.30, 133.17, 133.57, 134.27, 137.26, 137.50, 139.58, 141.24, 145.65. Anal.Calcd for $C_{53}H_{53}ClN_2Si_3$: C, 75.99; H, 6.38; N, 3.34 %. *Found*: C, 75.89; H, 6.30; N, 3.42 %.

*2-(4-(2,2,2-Tris(dimethyl(phenyl)silyl)ethyl)phenyl)-1-(4-fluorophenyl)-4,5-diphenyl-1H-imidazole (***5e***)*

White powder (85 %), M.P. = 189–191 °C, ν_{max} (KBr) 3417, 3064, 2957, 2917, 1605, 1563, 1507, 1424, 1312, 1251, 930, 837 (Si–CH_3), 735, 701 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.25 (s, 18H, $SiMe_3$), 3.63 (s, 2H, CH_2), 7.28–7.44 (m, 31H, ArH), 7.66 (d, J = 7.1 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 1.44 ($SiMe_3$), 12.70 ($C(SiMe_3)_3$), 35.32 (CH_2), 115.02, 115.24, 125.67, 126.41, 127.08, 127.18, 127.45, 127.58, 127.73, 127.76, 127.82, 127.95, 128.99, 129.08, 130.07, 130.24, 130.29, 134.29, 137.41, 139.60, 141.15, 159.60, 162.07. Anal.Calcd for $C_{53}H_{53}FN_2Si_3$: C, 77.51; H, 6.50; N, 3.41 %. *Found*: C, 77.49; H, 6.52; N, 3.34 %.

*2-(4-(2,2,2-Tris(dimethyl(phenyl)silyl)ethyl)phenyl)-4,5-diphenyl-1-p-tolyl-1H-imidazole (***5g***)*

White powder (87 %), M.P. = 203–205 °C, ν_{max} (KBr) 3419, 3065, 2959, 2922, 1598, 1494, 1450, 1254, 931, 836 (Si–CH_3), 764, 700 cm^{-1}. ^1H NMR ($CDCl_3$, 400 MHz): δ (ppm) 0.24 (s, 18H, $SiMe_3$), 2.32 (s, 3H, CH_3), 3.61 (s, 2H, CH_2), 6.97 (d, 2H, J = 8.1 Hz, ArH), 7.05 (d, J = 8.1 Hz, 2H, ArH), 7.18–7.43 (m, 27H, ArH), 7.65 (d, J = 7.5 Hz, 2H, ArH). ^{13}C NMR ($CDCl_3$, 100 MHz): δ (ppm) 2.15 ($SiMe_3$), 13.39 ($C(SiMe_3)_3$), 20.83 (CH_3), 36.03 (CH_2), 126.21, 126.97, 127.10, 127.15, 127.52, 127.79, 127.83, 127.98, 128.17, 128.20, 128.38, 128.47, 128.50, 129.37, 130.42, 130.81, 130.85, 134.19, 134.93, 135.01, 137.74, 140.35, 141.51, 146.49. Anal.Calcd for $C_{54}H_{56}N_2Si_3$: C, 79.36; H, 6.91; N, 3.43 %. *Found*: C, 79.25; H, 6.89; N, 3.38 %.

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