Welding in the World (2023) 67:831–832
https://doi.org/10.1007/s40194-023-01509-3

EDITORIAL

Additive manufacturing processes and performance

Majid Farajian[1]

Accepted: 27 February 2023 / Published online: 10 March 2023

As with the African saying "…little by little, a little becomes a lot" to express the power of the continuous and concentrated small steps and the effort to make a dream come true, so is the evolution of additive manufacturing. These philosophical words characterize the nearly three-decade development of a series of production processes based on layer-by-layer addition of materials that have the potential to replace many of the "subtractive" processes that have dominated manufacturing of finished products for over 100 years. This development has occurred in parallel with progress in the fields of computer-aided design and material digitalization for industries facing challenges regarding resource shortages. The evolution of additive manufacturing will also support the development of lightweight, carbon–neutral, and sustainable solutions with shorter turn-around times and more flexible production.

Additive manufacturing is a generic term describing a set of technologies and range of processes with common objectives, i.e., flexibility, productivity, cost reduction, and realization of complex geometries in a multi-material structure with optimum design. These include 3D printing, rapid prototyping, selective laser melting, selective laser sintering, laser metal deposition, plasma deposition manufacturing, wire arc additive manufacturing, and laminated object modelling. There is no doubt that the additive manufacturing of components and structures which are designed to operate under severe thermo-mechanical-chemical conditions would not be possible without applying the fundamental principles of welding. The strong relationship between additive manufacturing and welding processes has led the International Institute of Welding (IIW) to incorporate additive manufacturing into the working program of Commission I. Over the past five years, IIW has sponsored several international conferences, seminars, and workshops on this topic and will continue to promote the evolution of additive manufacturing through its technical activities.

The International Congress on Welding, Additive Manufacturing (ICWAM) is one of these scientific events, organized by Institut de Soudure and supported by IIW. Both ICWAM I (2018) and (ICWAM II) resulted in topical collections on additive manufacturing that were published in *Welding in the World*. This special issue entitled "Additive Manufacturing Processes and Performance" includes selected papers from ICWAM III (June 2022) and others presented at the IIW annual assembly in Tokyo (July 2022). Additional papers from this topical collection can also be found online at the journal website (https://link.springer.com/journal/40194/volumes-and-issues).

The papers in this issue deal mostly with both the wire arc additive manufacturing and laser powder bed fusion processes. A range of materials including high-strength steels, aluminum alloys, nickel-base and titanium alloys are included with emphasis on deposit quality, metallurgical characterization, and mechanical properties. There are also papers that describe quality assurance and non-destructive techniques used to study process-related imperfections for better performance of the manufactured components and structures.

The potential of additive manufacturing processes is still to be realized and will require a better understanding regarding the AM processes and the behavior of AM components under severe loading conditions. In addition to destructive testing, the development of non-destructive testing techniques will be critical to the acceptance of AM

✉ Majid Farajian
farajian@slv-duisburg.de

[1] GSI Gesellschaft für Schweißtechnik International mbH, Duisburg, Germany

in industrial practice. These methods could range from systems for differentiating between parts with defects and those that are defect-free, to systems for characterizing properties and residual stresses. Numerical tools for process simulation and analyzing the component behavior could go hand in hand with the experimental investigations for fully utilizing all the potentials.

As noted above, the fundamental knowledge of welding processes and weld performance, which has been the focus of the IIW technical commissions for many years, forms a solid basis supporting the evolution of additive manufacturing technology. *Welding in the World* will continue to serve as IIW's platform for the publication of technical papers that describe the science and technology of additive manufacturing and its application to industry.