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Welding Processes and Automation - Modern Variants of Classical Technologies

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Counting on Lavoisier's consent, I borrow the statement of the law of conservation of mass and take the liberty to adapt it to describe not a physical principle, but a patent feature of the current scenario of technological development of mankind: nothing is created, everything is transformed. If we narrow the analyzing spectrum down to our métier, one realizes that for each of the fundamental principles of the welding processes once created, a continuous evolution is observed, which is based on adaptations, additions, combinations, ultimately tool manipulations made possible by interventions over technical aspects of the different systems, with no change in their premises and most basic properties. Since the introduction of processes that might be subjected to electronic/electromechanical control (we highlight Arc Welding, from the 1880s; Resistance Welding, 1890s; Friction Welding, 1960s and Beam Welding, 1950s), scientific research and technological development efforts targeted to electronics elements, sensors, physical principles, mechanical design of torches and heads, automation and mechanization, as well as innovative applications, have been promoting the generation of a wealth of new techniques that populate the agenda of scientists and engineers around the globe.

Although this reality provides the industry with a range of options, which are able to dismantle paradigms and that very well could be objectively selected and adapted according to each welding condition, one notices, as clearly as a cathodic spot of a 520 A TIG arc (addressed in this issue), difficulty and reluctance in adopting innovations. The reason? The functional complexity of a process grows in phase with the growth of its capacity to be adapted to different welding situations, to deal with special materials and conditions difficult to approach (which themselves can be mutants along the weld), with its robustness and autonomy level and with the degree of refinement in which it can be adjusted. In addition to the technical problematic involved, this sets up a fertile ground for anachronistic minds to base their arguments for anchoring to outdated technologies. As a result, it is observed that most of the time the modern technologies remain under the auspices and use by scientists, not completing their due course, which would be the industrial implementation and consequent benefits of competitiveness. The response, however, should be diametrically opposed: greater understanding and dissemination of modern technologies is necessary, as is the increase of their applicability. This goes through applied research on the processes, but also through actions focused on greater usability of the developed systems.

From this viewpoint this special edition was devised, in which we can see that: special torch design resulting from the observation and study of physical arc phenomena allows for expansion of the application envelope of the TIG process, including brazing operations, as do new philosophies of adding material, resulting from hardware and software innovations in the power source; monitoring systems can autonomously determine the specific conditions of a weld and suggest consistent parameterization; new applications made possible by innovations in machine design emerge for the friction welding process. Certainly, a single issue could not encompass the full array of Modern Variants of Classical Technologies that are boiling in the welding world. I hope, however, that the number will serve as a catalyst and contribute so that the embryo of curiosity and urge to innovate both in the academia and industry nucleates in our readers.