

## Microstructural and Mechanical Characterization of a 16MND5 Steel Manufactured by Innovative WAAM SAW Process

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**Abstract :** Wire Arc Additive Manufacturing (WAAM) allows the rapid production of large, homogeneous parts with complex geometry. However, in the nuclear field, parts can reach dimensions of ten to a hundred tons. In this case, the usual WAAM TIG or CMT processes do not have sufficient deposition rates to consider the manufacture of parts of such dimensions within a reasonable time. The submerged arc welding process (SAW, Submerged Arc Welding) allows much higher deposition rates. Although there are very few references to this process for additive manufacturing in the literature, it has been used for a long time for the welding and coating of nuclear power plant vessels, so this process is well-known and mastered as a welding process. This study proposes to evaluate the SAW process as an additive manufacturing technique by taking as an example a low-alloy steel of type 16MND5. In the first step, a parametric study allowed the evaluation of the effect of the different parameters and the deposition rate on the geometry of the beads and their microstructure. Larger parts were also fabricated and characterized by metallography and mechanical tests (tensile, impact, toughness). The effect of different heat treatments on the microstructure is also studied.

**Keywords :** WAAM, low alloy steel, submerged arc, characterization

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