
Use of plasma-arc source in large-scale additive-manufacturing, also for the deposition of materials of interest in plasma-confinement applications for fusion

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Résumé

This talk will be split into two distinct parts. Firstly, the use of a plasma transferred arc (PTA) as a thermal power source for wire based additive manufacture (WAM) of metre scale engineering structural parts will be described. The PTA source is very beneficial as a power source for the WAM process and its advantages compared to other power sources such as lasers or conventional welding arcs will be highlighted. Indeed examples of components made successfully in WAM using the PTA source will be shown. However, there are potential issues when using PTA, typically related to high arc pressure, which could cause defects in the deposited material. Therefore, the arc pressure of a PTA source has been characterised experimentally. Operational regimes that avoid defects related to arc pressure have been identified and provided. The second part of the talk will illustrate how the WAM process has been used to produce large structures in tungsten, tantalum and molybdenum for application in plasma-confined fusion-reactor systems. The details of this process will be highlighted along with microstructural analysis and material properties. The production of a graded structure between these materials will also be discussed.

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