PhD in Fusion Science and Engineering
Università di Padova e Napoli "Federico II"

Call for admission to the PhD courses 2022/23 (XXXVIII cycle)

Research topic funded by INFN-Sezione di Padova

PROJECT TITLE	Additive manufacturing of refractory metals for nuclear fusion applications
FUNDED BY	INFN-Sezione di Padova
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SHORT DESCRIPTION	Refractory metals have peculiar characteristics, such as: extremely high melting temperatures, high corrosion resistance, hardness and wear resistance and high mechanical strength at prohibitive temperature. These metals are used in high value-added sectors such as aerospace, biomedicine, and nuclear physics. Refractories are commonly selected as plasma facing materials in nuclear fusion devices, like ITER. The major issues related to the use of these metals are the significant costs of the raw materials and the difficulties in their processability with the traditional manufacturing approaches. Additive Manufacturing represents one of the most innovative technologies to produce components made of such metals. Indeed, AM techniques allow to reduce the total cost: it is possible to create objects using a very reduced quantity of feedstock and the material waste is minimal as well. Moreover, very complex geometries can be created in just one step. However, the final properties of the additive manufactured parts are strongly affected by the process conditions. Several aspects need to be investigated: the PhD here proposed will be focused on the study of the mechanical, physical and thermal characteristics of the refractory metals manufactured by the AM technique Laser Powder Bed Fusion (LPBF). Surface finish of the parts will be also evaluated, and surface treatments will be performed to improve it. For doing so, the project involves the following activities: • Characterization of feedstock material; • Process parameters optimization; • Characterization of samples produced by LPBF (microstructural, structural, and thermal) • Study of the relation between process parameters and as-bult roughness; • Surface finishing treatments The printability of W (bulk and porous) will be studied in deep, but also refractory alloys specially studied for AM will be developed. A six-months internship will be held at EOS.