MATERIALS SCIENCE AND TECHNOLOGY

PNRR - Hot Isostatic Pressing of Metallic Materials: manufacturing and post processing technique

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	The research will assess the benefit to cost ratio of Hot Isostatic Pressing (HIP) applied to metallic materials. HIP and HIP-quench technologies will be extensively applied to materials for the aeronautic and energy production sectors. HIP will be used both to consolidate powders within shaped capsules and to post process Additive Manufactured parts. PNRR M4C2, Investimento 1.5 - Avviso n. 3277 del 30/12/2021 - ECS00000036 Nord Ovest Digitale E Sostenibile (NODES) - CUP E13B22000020001
Objectives	The research will study technological and economical features of Hot Isostatic Pressing (HIP) applied to metallic materials. Difficult to work and to forge materials for the aeronautic and energy production sectors will represent the major topics of the program, being highly alloyed steels and nickel superalloys the main materials studied. In terms of HIP technology, the analysis of benefit to cost ratio of the so called HIP-quenching system will represent the core of the activity. With such technology it is possible to quench at medium and high cooling rates the materials/components directly from the HIP temperature. Quenching in pressurized conditions is also possilble, thus limiting distortion. One of the aims of the research is to achieve a comprehensive understanding of mechanisms governing the HIP both as a Net Shape technique to consolidate metallic powders and as Post Processing technique for cast and Additive Manufactured (AM) parts. Further to the well known effect of closing internal residual flaws or reaching full consolidation of loosen powders, the capability of HIP to microstructurally homogenize materials will be investigated. The effects of pressure, time, temperature and cooling rate on the achieved microstructural and mechanical properties will be investigated and deeply discussed. Both experimental and numerical simulation techniques will be

	used to drive the understanding of such complex mechanisms.

Skills and competencies for the development of the activity	Knowledge and competences on the Metallic Materials Science and Technology are useful for the development of the research. Competences on the mechanical/aeronautical engineering fields are also warmly welcome. Basic or advanced knowledge on the use of software for numerical simulation could also be useful although not strictly necessary.