הטכניון TECHNION
מכון טכנולוגי לישראל Israel Institute of Technology

הפקולטה להנדסת מכונות Faculty of Mechanical Engineering

SEMINAR - סמינר

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 27.07.2020
(ו' באב תש"פ), בשעה 14:30 באמצעות הזום:
https://technion.zoom.us/j/95470486886

מרצה:

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על הנושא:

Powder Bed Fusion Additive Manufacturing Investigations

The seminar will be given in English

להלן תקציר ההרצאה:

Powder-bed fusion additive manufacturing (PBF-AM) has attracted increasing attention from industries due to their capability of producing geometrically complex functional components with high dimensional precision and good surface integrity. During PBF-AM, the powdered material is selectively consolidated by melting using a heat source, such as an electron beam or laser beam which are called Electron Beam Melting (EBM) and Selective Laser Melting (SLM). However, during the PBF-AM, the high local energy input and layer by layer manufacturing characteristic induce a very complex thermal history, such as rapid heating and cooling processes, in addition to the interactions among the thermal, mechanical, and metallurgical phenomena.

Both experimental and numerical methodologies have been developed and implemented to comprehensively understand the PBF-AM. Various subjects in EBM and SLM have been investigated, including: (1) the influence of the beam scanning speed and support structure on the EBM Ti-6AL-4V part; (2) the effects of build height, thermal cycles, and post-heat treatments on the SLM Inconel 718 part; (3) the evolution of the residual stress; and (4) the microstructural evolution in the SLM Inconel 718 alloy.

The major findings are: (1) A typical columnar and equiaxed microstructure was observed in the side surface and scanning surface of the AM parts, respectively. Fine colonies of cellular dendrites with a cell spacing of 0.511 ~ 0.845 μm were revealed in the Inconel 718, which indicated a cooling rate of $1.74 \sim 3.88\times 10^7\ K\cdot s^{-1}$. (2) With increase of the build height, the dominated values of the thermal gradient decreased first until a stable point and then slightly increased at the ending process. More defects (porosity and un-melted particles) were observed in the overhang region. The solid-gas support structure acted as a heat sink to enhance heat transfer and provided support for the overhang to avoid the occurrence of sink phenomena. The residual stress is unevenly distributed in the parts and the volume fraction of the porosity is below 2%. Post heat treatments can homogenize the microstructure and significantly improve the mechanical properties of the fabricated parts. (3) The phase-field method is a powerful tool for quantitative simulation of microstructural evolution in the SLM process to predict the morphology and size of the microstructure in solidification. This work would contribute to the understanding and further optimizing of the EBM and SLM processes, as well as the microstructure evolution and resulting mechanical properties of the produced parts.

מארח: פרופ' מיכאל שפירא

בברכה,

פרופ"ר מתי' סוס
מרכז הסמינרים