סמינר מחלקתי – הנדסת חומרים

הנך מוזמן בזאת לסמינרים אשר יתקיימו ביום ה׳, 17 במאי 2018, ג׳ בסיון תשע״ח
בשעה 14:00, בניין 51 חדר 15 (באודיטוריום)

Thermophysical properties of additively manufactured (AM) Ti6Al4V and AlSi10Mg alloys

Einat Strumza

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The Additive Manufacturing (AM) process has rapidly developed in the past two decades and is now serving the needs of industries for the fast production of parts with complex shapes and tailored properties. Ti6Al4V and AlSi10Mg alloys are the most common alloys fabricated by the selective laser melting (SLM) and electron beam melting (EBM) AM methods. Over the years a considerable effort has been taken to explain the effect of the processing parameters on the microstructure, and the mechanical properties of these AM parts. Nevertheless, the thermophysical properties were determined only at room temperature.

In the present talk, the thermophysical properties (thermal expansion, heat capacity, and thermal conductivity) of Ti6Al4V and AlSi10Mg up to 1273 K and as a function of printing direction and two fabrication methods will be presented.

The thermal expansion and thermal conductivity of the two alloys were measured in two directions; parallel to the printing direction (Z direction); and perpendicular to it (X direction). In both directions, the samples show differences in thermal expansion and thermal conductivity compared to those properties of conventionally fabricated samples.

For the AlSi10Mg alloy, an abnormal non-linear thermal expansion caused by thermally induced porosity (TIP) phenomenon as confirmed by the microstructural analysis and μ-CT was demonstrated. The TIP found is more dominant in the X direction than for the Z direction. The effect of the anisotropy in the printed parts was also observed in the diffusivity and conductivity measurements.

For Ti6Al4V, the effect of the processing and microstructure on the thermophysical properties of Ti6Al4V in the two fabrication methods compared to the conventionally made alloy will be discussed. The presences of the intermetallic phase ($Al_3V_{0.333}Ti_{0.666}$) was identified using the XRD and TEM analysis in the samples after the heat treatment.

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Bioinspired Volatile Organic Compound Sensing

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Analysis of volatile organic compounds (VOCs) of exhaled breath samples of patients is suggested to be a very attractive way to diagnose illnesses such as cancer, diabetes, and asthma. Sensitive detection of VOCs is also a major challenge in environmental control due to the need to detect chemical pollutants, which are byproducts of industrial processes, automobiles and homes. Nanomaterials have been utilized as VOC sensing elements due to their high surface-to-volume ratio and unique electrical and chemical properties. Most commonly such nanomaterials are functionalized with organic receptors of the VOCs in order to promote the detection process and increase the selectivity of the process. In this talk I will show that peptide based conducting materials, which can exhibit both high surface-to-volume ratio and high modularity in designing specific receptors, are promising materials for the development of VOC sensors.

Our design is based on cyclic peptides that self-assemble into proton conducting nanotubes. Three peptide sequences: $c(K\underline{F})_4$, $c(K\underline{Y})_4$ and $c(K\underline{W})_4$, are used to demonstrate VOC detection capacity. Enhancement of the conductance of the nanotubes with introduction of several type of VOCs is demonstrated, with apparent sensitivity to both polar (ethanol, furfural) and non-polar (petroleum ether) VOCs. Furthermore, each sequence exhibit different response to the different VOC tested, providing possibility for developing an array of semi-selective elements for “electronic nose” VOC detection schemes.