WWU MÜNSTER

Nuri Choi
Arbeitsgruppe Prof. G. Wilde
Institut für Materialphysik

Topic: Structural and kinetic properties of interface in additively manufactured CoCrFeMnNi high-entropy alloy

Additive-manufactured or so-called 'printed' products possess defects induced by rapid melting/cooling, such as cracks, balling effect, non-melted particles, element segregation, precipitation, heat affected zone, etc. [1-4]. Researches have been reported to reduce the defects with process parameters (laser power, scanning speed, etc.) but certain defects in matters are inevitable [4-6]. Especially, printed materials have much higher dislocation density than cast alloys. The point defects, e.g. vacancies, are temperature-dependent equilibrium defects but it is difficult to evaluate the density of residual vacancies in printed metals with thermal gradient, and there is no report about non-equilibrium vacancies in printed metals, until now.

Furthermore, interfaces in AM-produced materials may be in a higher energy state than in relaxed polycrystalline materials that might result in enhanced atomic diffusion. Particularly segregation, precipitation and stress concentration mainly occur at the grain boundaries and grain boundary diffusion in AM materials must be understood systematically. As diffusion plays an important role in numerous structural and physical properties such as phase transformation, precipitation and creep, etc., precise comprehension of diffusion phenomena could not only improve quality of printed material but also increase their applicability.

Therefore, the ultimate objective of the planned work is to investigate kinetic properties of interfaces by measuring grain boundary diffusion and non-equilibrium structural features in CoCrFeMnNi HEA produced by AM process. It will be an answer for phenomena such as precipitation and segregation, which occurs in additive-manufactured matters.

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