

# Directed Energy Deposition (DED) and the New Tel-Aviv University 3D Printing Research and Development Center

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## Abstract

The AM market of metals is rapidly growing. There are several AM processes that are used to manufacture metal parts, the two most common ones are *powder bed fusion* (PBF) and *directed energy deposition* (DED). PBF allows printing more complex geometries with finer features and surface roughness compared to DED. In contrast, DED allows for a larger materials range; denser and stronger printed materials; printing of multimaterials (ceramics, composites, and functionally graded materials, FGMs) in the same machine; printing either full parts or local features, coatings, or repair; faster build speeds; larger build volumes; printing on non-horizontal surfaces; use of larger powders for DED with laser compared to PBF with laser; printing in zero-gravity environment (in the case of processes that utilize wire-feed, electron beam, and vacuum environment). Due to the low heat input, with small melt pool and high travel speeds, the deposits cool very fast (typically, 1,000-5,000 °C/s). This generates very fine grain structures that may be one order of magnitude smaller in size than comparable wrought products. Therefore, the mechanical properties and the quality of the deposits are typically better than castings and approach properties of wrought products. Thus, PBF and DED can be regarded as complementing technologies, rather than competing technologies. Tel-Aviv University is currently founding a new 3D Printing Research and Development Center, which will operate the first DED machine in Israel, which is also the first hybrid system in Israel. Collaboration is welcome with academia, industry, and defense organizations. The [Laser Engineered Net Shaping \(LENS™\)](#) process of Optomec (Albuquerque, NM) will be the nucleus of the new Center. More specifically, the [LENS™ 3D Hybrid 20 Controlled Atmosphere System](#), with full 5-axes CNC machining and printing capability, 2 kW fiber laser, a glove box with argon atmosphere and an integrated gas purification system that maintains oxygen and moisture levels to below 10 ppm, 4 powder feeders, thermal imager, and melt pool sensor, will be installed.

## Short Biography

Professor Noam Eliaz is the founder of the Department of Materials Science and Engineering at Tel-Aviv University (TAU). He is currently the founding Director of TAU+, TAU 3D Printing Research & Development Center. He received his B.Sc. and Ph.D. (direct track) in Materials Engineering as well as M.B.A., all *cum laude* from Ben-Gurion University. He served for three years in the Department of Materials and Failure Analysis of the Israel Air Force. He has published about 400 research publications, including three edited books. He has garnered numerous awards, including the Fulbright and Rothschild postdoctoral scholarships (1999-2001), T.P. Hoar Award for the best paper published in *Corrosion Science* (2001), JSPS fellowship (Japan, 2005-



7), NACE International's H. H. Uhlig Award (2010), Fellow Award (2012), and Technical Achievements Award (2014), and Northwestern University's Eshbach scholarship (2013). In 2015 he was elected to the Israel Young Academy. Noam is an 8<sup>th</sup> generation Israeli. In January 2017 he was appointed by Israel's Minister of Science, Technology, and Space as a member of the Governing Board of The German-Israeli Foundation for Scientific Research and Development (GIF). In March 2017 he was appointed by the President of The Israel Academy of Sciences and Humanities as a member of the follow-up committee of the "State of Science in Israel." Noam is married to Billie and the proud father of Ofri, Shahaf and Shalev.