HiETA technologies

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SELECTIVE LASER MELTING

FOR HEAT EXCHANGERS AND REACTORS

HiETA Technologies is pioneering the use of Selective Laser Melting (SLM) – a metal powder-based version of Additive Layer Manufacturing – for compact heat exchangers and reactors. SLM allows almost complete 3-D design freedom for extremely complex, internally voided, thin-walled components. For heat exchangers and reactors, SLM provides potentially greater compactness, higher efficiency, and lower size, mass and costs. HiETA is developing pure tube-in-tube counter-flow heat exchangers with hydraulic diameters of less than 1 mm, with complex heat-exchanging headers that can help to reduce the core size.

Initial applications are for aerospace, and for automotive heat engines, particularly recuperators for micro-turbines, where we anticipate size and mass reductions of up to 25% compared with existing plate-fin heater exchangers, with small increases in effectiveness. The ability of SLM to integrate the heat exchangers with other engine components leads to further performance benefits. We can also use SLM for heat exchanger/reactors, where the design flexibility allows complex, multi-fluid paths in a wide range of formats. We are also working on the use of porous SLM materials. The metal powders generally available are bronze, aluminium, stainless steel, nickel, titanium and cobalt chrome alloys: the range is widening as potential users become more familiar with the process.

A constraint on these developments is the relative immaturity of the SLM industry. There are as yet no generally accepted standards on powder specification or on the properties of the final materials, which can vary between different SLM machine manufacturers, and also on the build orientation. At the moment, the process is expensive, and productivity levels are geared more to prototyping than to mass production. However, change in the industry has been rapid: productivity has increased by more than an order of magnitude over the past seven years, and machine manufacturers are confident that they will be able to reduce costs and increase productivity dramatically as demand builds up and it becomes cost effective to develop machines dedicated to specific products. HiETA is leading a TSB-funded project consortium designed to accelerate development of the SLM supply chain, targeting the cost effective production of 50,000 recuperators for a micro-turbine range extender for an electric vehicle within 3-5 years.

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