

DYME - A Dynamic Meltpool Emissometry Technique for High Temperature Materials Characterization

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Radiative property measurements at high temperature have to deal with a number of challenges, including possible sample contamination from the container or surrounding space, as well as contamination of collecting optic or windows by evaporated sample material. Fast measurement techniques allow one to deal with both of the above issues at the price of a very limited integration time and an inability to implement measurement methods requiring sequential measurements. We are proposing a new DYME (DYnamic Meltpool Emissometry) technique, which combines a very short exposure of any part of the sample to high temperature together with an ability to provide several seconds of measurement time. This enables us to realize measurement of complex sequences. In our approach, reflectance and emittance measurements are performed dynamically with in-line (shared with a heating high-power laser) registration of the optical path, which includes a 2D optical scanner. We are able to treat a fast moving melt pool (or a hot spot) as a static measurement target, while providing better tolerance to the residual oxygen levels, reduced sample contamination, and fewer issues with sample evaporation (due to the small area of the heated zone). This method will become a core element of the new TEMPS (Temperature and Emittance of Melts, Powders and Solids) facility under construction at NIST. TEMPS is aimed at significant improvement of our understanding of emissive properties of metals, ceramics and polymers in different aggregate states in the visible and thermal infrared at temperatures up to 3500 K (and potentially higher) in a vacuum or a low-oxygen purge gas environment. TEMPS will be co-located with another facility, related to Additive Manufacturing research, which is beyond the scope of this presentation.