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Self-adjusting EDM/ECM high speed drilling of film cooling holes

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Abstract: In order to reduce the thickness of recast layer and improve the surface quality of film cooling holes, a novel high speed self-adjusting electrical discharge machining (EDM)/ electrochemical machining (ECM) approach was developed by applying two independent flushing systems that were able to switch automatically in the machining process. The new flushing systems used different work-liquids and online dynamically changing discharge parameters. With the change in gap distance and the depth of the hole drilled, the dominant machining mechanism is graduated changed from EDM to electrochemical discharge machining (ECDM) and ECM. The formation mechanism of the recast layer on nickel alloy was investigated by comparing the surface characters of the bulk material and those of the recast layer using transmission electron microscope (TEM) and energy dispersive X-ray spectroscopy (EDS). The results from comparison experiments, in which different discharge parameters and sustaining time were applied, show that this new flushing systems would ensure much better flushing continuity of the working fluid and improve the discharge gap status. In addition, low voltage and current would benefit the ECM process and the removal of recast layer.

Keywords: EDM; ECM; Film cooling holes; Recast layer.