Short Communication

Electrochemical Machining of Turbulated Cooling Channel Using Gelatinous Electrolyte

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doi: 10.20964/2020.06.73

Received: 21 January 2020 / *Accepted:* 4 April 2020 / *Published:* 10 May 2020

The turbulated cooling channel in turbine blades is a typical special-shaped inner wall structure that can significantly enhance the cooling effect of gas turbine blades. The use of electrochemical machining to manufacture cooling channels has the advantages of high efficiency and no residual stress. However, the stray current removal cannot be completely avoided using liquid electrolyte. Consequently, an ideal inner wall structure, consisting of a turbulated cooling channel, cannot be obtained. In this paper, an electrochemical machining method is proposed in which a gelatinous electrolyte is used to meet the machining requirements. Through the cross-linking of polymers, a liquid electrolyte is filled into the gaps of the gelatinous network structure to form a gelatinous electrolyte. The stray current removal due to the flow of the liquid electrolyte is avoided. A gelatinous electrode of diameter 5 mm was prepared. A turbulated cooling channel with a rectangular cross section and rib height of 0.8 mm on nickel is obtained. The profile view of the experimentally prepared turbulated cooling channel structure has a rectangular cross section and maintains good straightness. The proposed machining method is expected to be widely applicable to electrochemical machining of the inner wall structures in narrow spaces.

Keywords: electrochemical machining; turbulated cooling channel; gel; electrolyte; rib

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