

عنوان مقاله:

Towards sustainable machining of 17-4 PH stainless steel using hybrid MQL-hot turning process

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خلاصه مقاله:

The use of a minimum quantity of lubrication (MQL) with extremely low consumption of lubricant in machining processes has been reported as a technologically and environmentally feasible alternative to conventional flood cooling. In hot machining, the external heat source is applied during machining that will assist to increase machining performance. Many external heating techniques are available and each type has advantages/disadvantages. 17-4 PH stainless steel (AISI630) is martensitic stainless steel, which is widely used in energy equipment, aerospace and petrochemical industries. The objective of the present paper is to integrate MQL technique, for the first time, with a hot turning process for finding an optimum possible hybrid technique for a particular machining process. The effects of different machining parameters on MQL turning of 17-4 PH stainless steel have been investigated in comparison with dry and wet machining processes. Experiments were also designed for machining using MQL and dry techniques to evaluate surface roughness, tool wear, machined surface morphology, chip morphology as well as chip formation mechanism under different pre-heating temperatures. The results show that applying MQL technique with online thermally enhanced turning (MQL-hot turning) increases the efficiency of machining of 17-4 PH stainless steel. The cutting parameters and pre-heating temperature are important parameters and should be selected carefully when using hybrid MQL-hot turning. In addition, machining with MQL is beneficial to the environment and machine tool operator health as lubricant consumption during operation with MQL is 7-fold lower than in the conventional system.

کلمات کلیدی:

Hybrid Machining, Hot Turning, Minimum Quantity Lubricant (MQL), Surface roughness, 17-4 PH Stainless Steel

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