

A Neural Network System for Predicting the Hardness of Titanium Aluminum Nitride (TiAlN) Coatings

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Abstract : The cutting tool, in the high-speed machining process, is consistently dealing with high localized stress at the tool tip, tip temperature exceeds 800°C and the chip slides along the rake face. These conditions are affecting the tool wear, the cutting tool performances, the quality of the produced parts and the tool life. Therefore, a thin film coating on the cutting tool should be considered to improve the tool surface properties while maintaining its bulks properties. One of the general coating processes in applying thin film for hard coating purpose is PVD magnetron sputtering. In this paper, the prediction of the effects of PVD magnetron sputtering coating process parameters, sputter power in the range of (4.81-7.19 kW), bias voltage in the range of (50.00-300.00 Volts) and substrate temperature in the range of (281.08-600.00 °C), were studied using artificial neural network (ANN). The results were compared with previously published results using RSM model. It was found that the ANN is more accurate in prediction of tool hardness, and hence, it will not only improve the tool life of the tool but also significantly enhances the efficiency of the machining processes.

Keywords : artificial neural network, hardness, prediction, titanium aluminium nitrate coating

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