

OPTIMIZATION OF CHEMICAL PRETREATMENT FOR  
REMOVING COBALT ON TUNGSTEN CARBIDE  
SUBSTRATE USING RESPONSE SURFACE  
METHODOLOGY

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Abstract

Diamond coating are commonly used in industries especially for application such as cutting tools, biomedical components, optical lenses, microelectronics, engineering, and thermal management systems. The diamond coating quality is strongly depending on substrate preparation prior to diamond coating. Thus, the several process parameters must be studied to obtain optimal parameters which lead high quality diamond coating. In this present work, an attempt was made to optimize pretreatment parameters namely temperature and time on cobalt removal of tungsten carbide. Full factorial experimental designs followed by Response Surface Methodology (RSM) were employed in this study to plan and analyze the experiment. The cobalt removal was the independent response variables. Empirical model was successfully developed to predict amount of cobalt removal on the substrate after single step etching process. Experimental results have shown that the temperature, time and time<sup>2</sup> are found to be the most significant factors for cobalt removal. Whereas for interaction of time and temperature were insignificant factors to influence cobalt removal. According to this study, the minimum cobalt content can be obtained at working temperature from 48° to 50°C for 3 minute.

**Keywords:** Diamond coating, RSM, full factorial design, tungsten carbides, cobalt removal

Abstrak

Salutan berlian biasa digunakan dalam industri terutama untuk aplikasi seperti alat memotong, komponen bioperubatan, kanta optik, mikroelektronik, kejuruteraan, dan sistem pengurusan haba. Kualiti salutan berlian adalah sangat bergantung kepada penyediaan substrat sebelum salutan berlian. Oleh itu, beberapa parameter proses perlu dikaji untuk mendapatkan parameter optimum yang dapat menghasilkan salutan berlian berkualiti tinggi. Dalam kajian ini, percubaan telah dibuat untuk mengoptimumkan parameter rawatan awal iaitu suhu dan masa pada penyingkiran kobalt tungsten karbida. reka bentuk eksperimen faktorial penuh diikuti oleh Metodologi Tindak balas Permukaan (RSM) telah digunakan dalam kajian ini untuk merancang dan menganalisis eksperimen. Penyingkiran kobalt adalah pemboleh ubah tindak balas bebas. model empirikal telah berjaya dibangunkan untuk meramalkan jumlah penyingkiran kobalt pada substrat selepas proses langkah pertama. Keputusan eksperimen telah menunjukkan bahawa suhu, masa dan masa<sup>2</sup> didapati menjadi faktor paling penting bagi penyingkiran kobalt. Manakala bagi interaksi masa dan suhu adalah faktor penting untuk mempengaruhi penyingkiran kobalt. Keputusan menunjukkan kobalt minimum boleh diperolehi pada suhu dari 48° ke 50°C selama 3 minit.

**Kata kunci:** Salutan berlian, RSM, reka bentuk faktor penuh, tungsten karbida

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