ABRASIVE WEAR STUDIES ON COBALT ELECTRODEPOSITED SURFACES WITH TiO\textsubscript{2} DISPERSIONS

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ABSTRACT
Cobalt depositions are generally preferred for high temperature applications. When a second phase of fine tough particles are incorporated in the coating matrix, Tribological properties are found to have improved much. The performance of such composite depositions have rarely been assessed towards different mating conditions. Cobalt depositions with engulfed TiO\textsubscript{2} particles were studied for their performance towards abrasive wear and are reported. Effect of heat treatment of these depositions on the surface mechanical properties were studied. Surface microhardness and wear loss due to rubbing abrasion were estimated on coated panels before and after heat treatment in the range of 100-700°C. The composite containing 12.5% by volume of TiO\textsubscript{2} and heat treated at 600-700°C were found to exhibit high abrasion resistance. This is attributed to the formation of glass like layers on the surface.

INTRODUCTION
The endearing characteristics of composite coatings include high wear resistance and improved surface mechanical properties. Automobile parts and machine tools which wear out at high temperature under stress may be provided with a hard cobalt coating\textsuperscript{1}. The surface mechanical properties of such coatings have to be considerably improved to offer resistance to wear at elevated temperatures\textsuperscript{2}. Cobalt coatings are employed in such engineering applications to combat tough mating conditions at high temperatures. Electrodeposition is a low cost versatile method used for such surface build up and if fine tough particles are embedded (co-deposited) in the coating matrix the performance could be much improved. TiO\textsubscript{2} particles were co-deposited in Cobalt coatings to observe the surface behaviour towards abrasive wear. The coatings were subjected to post heat treatment and were tested for Microhardness(HV) and abrasive wear resistance using a precision built test instrument “Taber Abraser (model 174)” as reported by Kalyanaraman etal\textsuperscript{3}. A sulphate bath was employed for depositing Co and the coated specimens were subjected to heat treatment for 1hr from 100°C to 700°C to observe the surface changes and were then tested for surface microhardness (HV) and abrasive wear resistance.

EXPERIMENTAL
The dispersive coatings were deposited from suspensions composed of electrolytes containing metal sulphates, boric acid and additives with 50-200g/L of fine tough TiO2 particles. The coating thickness was kept at 30µm. Optimum deposition conditions, such as current density, temperature, concentration, pH, etc., for uniform good coatings were achieved by performing many trials. Abrasive wear tests conducted using the Taber Abraser revealed abrasion resistance at all angles relative to the grain or weave of the material. The wear rate was established by a relative term typical of the testing.