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**Interfacial Microstructure and Mechanical
Properties of WC-Co Oxyacetylene Brazed Joints
Using Ag-Based Filler Alloy**

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ABSTRACT

An attempt was made to understand the brazeability of different WC-Co grades (6 and 10 wt% Co) and the impact of brazing parameters on the mechanical properties of the brazed joint, while considering potential possibilities for using brazing as a refurbishing technology. The influence of surface oxide formation and interfacial microstructural evolution on the brazeability of WC-Co at common interfaces was investigated. Thermal oxidation was carried out in a muffle furnace at different oxidation times in the temperature range 400 - 750°C, in air. Oxidation of the WC-Co samples increased significantly with temperatures above 600°C. At higher oxidation times, mass gain increased with decreasing Co content. As a result of early and increased preferential formation of a protective oxide scale, WC-10wt%Co experienced less surface oxidation than WC-6wt%Co at higher oxidation times. The oxide scales contained mainly the dense CoWO_4 , mixed with the porous WO_3 .

WC-Co samples were oxyacetylene brazed at common interfaces using a B-Ag49CuZnMnNi filler alloy under atmospheric conditions at 710°C for 30 seconds. The braze interlayers, for both 8 and 24 μm thicknesses, consisted mainly of light $\alpha\text{-Ag(s.s)}$ and dark $\alpha\text{-Cu(s.s)}$ phases. There was no evidence of an interfacial oxide layer formation, instead the diffusion of Co into the interlayer was observed. Increasing the interlayer thickness promoted the formation of Ag-Cu-Zn eutectic phases in the interlayer, in addition to $\alpha\text{-Ag(s.s)}$ and dark $\alpha\text{-Cu(s.s)}$ phases. Changes in interlayer microstructure indicated the synergistic effect of inter-diffusion and Co content.

Joints with an interlayer thickness of 24 μm achieved higher shear strength than 8 μm joints. Shear strength largely depended on the dispersion strengthening effect of $\alpha\text{-Cu(s.s)}$ and Ag-Cu-Zn eutectic phases, which increased with increasing Co content. WC-6wt%Co showed a ductile fracture mode while WC-10wt%Co showed a mixture of ductile and brittle fracture modes.