

Enhancing Diamond Retention in Bronze Bonded Grinding Tools

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Diamond grit retention is a critical determinant of the operational performance of bronze-bonded grinding tools, primarily governed by the mechanical interlocking induced by thermal expansion difference between diamond and bronze. This study investigates pressure-assisted densification kinetics of diamond reinforced (10, 46 and 107 μm) bronze composites to enhance interfacial bonding via Spark Plasma Sintering (SPS). Results revealed that grain boundary sliding and dislocation-induced plastic flow co-dominated densification of the unreinforced matrix ($n \approx 2.5$). As reinforcement size increased, the dominant densification mechanism shifted from grain boundary sliding ($n \approx 2$) to dislocation-induced plastic flow ($n \approx 3$). Furthermore, the periodic peaks observed in the densification curve, coupled with grain growth relative to the starting powder ($D_0 < 2D_s$), indicated the occurrence of multi-peak discontinuous dynamic recrystallization (DDRX) mechanism within the microstructure during sintering. Depending on these kinetic insights, two distinct microstructural tailoring strategies were established to enhance interfacial bonding by manipulating process parameters: (i) shifting the DDRX mechanism from multi-peak to single-peak regime by increasing strain rate to induce localized grain refinement, and (ii) leveraging stages where dislocation-induced plastic flow is dominant to promote dislocation accumulation and increase local residual stress.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

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Invitation letter for visa

Yes

Authors: İŞLEK, Ertuğrul (Eskisehir Technical University); Dr SELIMOĞLU, Gül İpek (Eskisehir Technical University); Dr ÖZER, İsmail Özgür (Eskisehir Technical University)

Presenter: İŞLEK, Ertuğrul (Eskisehir Technical University)

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