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# New environmentally friendly coatings for hot forging tools

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**Abstract**

Two alumina coatings are developed to protect tool surface in hot forging: pure γ-alumina matrix loaded with α-alumina particles and pure γ-alumina matrix loaded with h-BN particles. The coatings are deposited on stainless tools by using a sol-gel procedure. Adherent coatings are obtained with an average thickness ranging from 200 to 300 nm. The coatings are tested according to the conditions of contact encountered in hot forging processes: coated tools slide against the surface of hot specimens where they generate a plastic strain. The design of experiment involves specimens heated to 1100°C, lubricated and unlubricated contact, small and large specimen plastic strain, uncoated and sol-gel coated tools. Tests results are the Coulomb's coefficient of friction, SEM-EDS and roughness measurement of the tool surfaces after a sliding length of 40 mm.

Results show that the tested sol-gel coatings remain firmly bonded to the tool surface. Compared to uncoated tools, alumina sol-gel coatings limit the amount of material transfer from specimen surface to tool surface. Loading the alumina sol-gel coating with h-BN particles significantly improves its friction behaviour: the friction coefficient is lower and sticking phenomena are reduced.

**keywords**: sol-gel coating, α-alumina, h-BN, friction, wear, hot forging