The role of friction in the microstructural evolution of alpha brass under oblique impact against steel

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Abstract. Alpha brass is a commonly used alloy due to its high strength, good ductility, and excellent corrosion resistance, and it has applications in various industries such as automotive, electrical, marine, and architecture[1]. The study aims to investigate the role of friction on the microstructural changes of the alpha brass subjected to high-speed oblique impact at different angles. The experiments were carried out using a ballistic setup to generate high-speed direct and oblique impacts. In the present study, brass balls with a diameter of 6.35mm were impacted against a hardened tool steel block with dimensions of 100mm×100mm×100mm at various grazing angles. The high strain rate tests were also conducted at different temperatures and strain rates using a Split Hopkinson setup to obtain Johnson-Cook plasticity[2] parameters. These parameters were then used in the LS-DYNA finite element code to simulate oblique impact experiments. By comparing various parameters such as velocity after impact, rotational velocity due to friction, and ricochet angle from both experimental and numerical results, the coefficient of friction (COF) between the brass and tool steel for the oblique impacts was determined. The microstructural evolution of the brass was analysed using Electron Backscatter Diffraction (EBSD) technique, which provided a detailed understanding of the deformation mechanisms and evolution of microstructure. By comparing the microstructural evolution under direct and oblique impacts, the results revealed that the effect of sliding friction leads to a more intricate microstructural evolution in oblique impacts than in direct impacts.

References

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