SHOCK DIFFRACTION IN ALUMINA POWDER

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In order to produce complex shaped components by dynamic compaction of ceramic powders detailed knowledge of their response under shock loading conditions is required. This work attempts to provide data on release effects and shock attenuation in 1 μm and 5 μm α-alumina powders which were compacted to between 85% and 95% of the solid phase density by the impact of high velocity steel projectiles. As in previous work, the powder was loaded into large cylindrical dies with horizontal marker layers of a contrasting coloured powder to provide a record of powder displacement in the recovered specimens. After recovery and infiltration with a thermosetting resin the specimens were sectioned and polished to reveal the structure formed by the passage of the projectile and shock wave. Al'tshuler et al (1960) has shown that the shock formed in the target material is progressively weakened by relief waves originating at the edge of the projectile where the one dimensional shock pressure cannot be maintained and that the region affected by this is influenced by the speed of sound behind the shock. Therefore, if initial conditions such as the velocity and shock response of the projectile and the density of the target powder are known, analysis of the shocked structure will provide good estimates of the shock pressure and the sound speed in the high density material at the shock pressure and will also give an indication of the impact conditions required for successful densification of the powdered material. Results indicate that the shock pressures generated were of the order of 0.5 to 1.4 GPa and higher, with shock velocities and sound speeds in the ranges 650 to 800 m/s and 350 to 400 m/s respectively.

References

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