Fragmentation Behavior Of Brittle Material Under High Velocity Impact In Constrained And Non-Constrained Conditions

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The purpose of this study is to design and conduct an experiment assessing the fragmentation behavior of mica-crystalline material under high velocity impact in constrained and non-constrained conditions. Research was made on brittle material—potassium fluorphlogopite KMg3[Si3AlO10]F2 (product of high-temperature remelting of nonferrous mineral oxide material). A 23 mm steel ball (Steel 20) was used as a projectile. In order to create constrained conditions of lateral compression, a device for mechanical clamping of the sample was used. The following experiments have been arranged: ball velocity 230 m/s collision angle 90; ball velocity 120 m/s collision angle 90; ball velocity 230 m/s collision angle 30; ball velocity 120 m/s collision angle 30. Overall, 8 experiments were conducted, 4 for each type of loading (constrained and non-constrained conditions). Parameters of destruction fragments have been established on the basis of images obtained by scanning electron microscopy (SEM) using X-ray spectral microprobe analysis. The established characteristics suggest that at identical impact velocities and collision angles, constrained conditions facilitate greater localization of deformation than in conditions when lateral compression is absent. Besides, constrained conditions promote formation of finely dispersed fragments through split-off phenomena and not only through dissipation.
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