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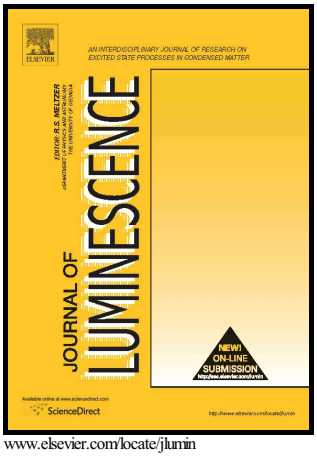

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Shock-wave induced mechanoluminescence: a new technique for studying effects of shock pressure on crystals

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Abstract

The impact of a projectile propelled to velocities in the range of 0.5-2.5 km/s on to a target (X-cut quartz crystal) produces shock waves travelling at velocity of nearly 10 km/s in target, in which intense mechanoluminescence (ML) pulses of microsecond duration are produced, both in compression and post-compression conditions. The piezoelectric field produced due to surface charges of fractured target, causes band bending and subsequently, the free charge carriers are generated in the respective bands and the emission of ML occurs. The ML appears after a delay time t_{th} whose value decreases with increasing value of the shock pressure. Initially, the ML intensity increases with the shock pressure because of the creation of more surfaces; however, for higher values of the shock pressure, the ML intensity tends to attain a saturation value because of the hardening of the crystals due to the creation of small crystallites in which the creation of new surfaces becomes difficult. The ratio between peak ML intensity in the