

Photochemical initiation of energetic materials on the surface of metal oxides

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The report demonstrates the possibility of controlling the sensitivity of pentaerythritol tetranitrate (PETN) to laser radiation by adding commercial powders of Mg [1] and Zn oxides. The key stage of the process is the photoinduced charge transfer from oxide to PETN molecules adsorbed on its surface, with the formation of metastable radical anions, the decomposition of which provokes the development of an explosive decomposition reaction in the material [2]. Initiated samples were represented by compressed polycrystalline tablets. Harmonics (1064, 532, 355 nm) of a YAG:Nd laser were used for initiation. The most photosensitive of the composites have an initiation threshold more than 5 times lower than that of pure PETN. The use of Zn oxide nanopowders, doped with Cu(II) oxide and Ag, with intensive absorption in the visible and near-infrared regions of the spectrum, made it possible to achieve even lower initiation thresholds using longer-wavelength laser radiation. The threshold of initiation by laser radiation with a wavelength of 532 nm for these composites turned out to be lower than that of the most sensitive aluminized PETN samples in the same conditions. It also allowed to successfully initiate a PETN using continuous-wave laser radiation with a wavelength of 450, 808 (13 W), and 1070 nm (1 kW). The study was funded by the Russian Foundation for Basic Research (grant No. 19-33-60013).

[1] Kuklja M M *et al* 2020 *Phys. Chem. Chem. Phys.* **20** 25284–25296

[2] Tsyshevsky R V *et al* 2015 *Surf. Sci.* **637** 19–28