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## Semi random lasing on ZnO nanoparticles originated by laser induced breakdown

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A simple laser-assisted method to transform metallic Zn to ZnO-based random lasing medium is reported. The method uses $Nd^{+3}$ laser-induced air breakdown to treat the surface of a Zn target in ambient air. ZnO nanoparticles produced are randomly and rarely scattered over the broken area. That was confirmed by an analysis of scanning electron microscope and x-ray diffraction data. At low temperature (5K) ZnO-based characteristic surface exciton is observed at arbitrary chosen point of the area surface. At room temperature ZnO characteristic spectra of two types were observed under resonant powerful photoexcitation. The first type exhibited well-known free exciton at 3.25 eV. The second type of spectra displayed emission band at around 3.14 eV (395nm) with regularly spacing narrow spikes (<1nm), which is typical of multi-mode lasing. The band is suggested to be originated from electron-hole plasma arising at high excitation in ZnO-based structures. The micro lasers revealed are possibly composed of ZnO nanoparticles scattered in chains inside self-made random resonators, with Zn flinders being mirrors. An analysis of excitation dynamics shows that photon life-time in the resonators is approximately 0.23 ps, the latter being determined by the laser output through resonant scattering.

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