Terahertz emission from ZnSe nano-dot surface

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ABSTRACT

As shown in Figure 1 (Fig. 1) ZnSe nano dots are fabricated on the surface of <111> orientation ZnSe using femtosecond laser ablation technique. In this work, we studied the THz generation properties of the ZnSe nano-dots by electro-optic detection configuration. Three THz radiation mechanisms are observed in experiments: current surge effect (drift current), Photo Dember effect (diffusion current) and optical rectification. Compared with bulk ZnSe, the ZnSe nano dots generated much higher THz radiation power at the same experimental condition. When the ZnSe nano-dots covered 10% of total radiation surface, the radiation power is about two times stronger than that from the bulk bare sample (Fig. 2).

Basicly, there are two kinds of mechanisms occur predominantly for the THz radiation of ZnSe nano dots: the first is lighting-rod effect that fields tend to concentrate at the tips of protrusions on surface; the second is local-plasmon effect that collective oscillation of electrons occurs in these protrusions. These two effects make the total surface electric field largely enhanced. In this study, we attribute the THz radiation enhancement phenomenon of ZnSe nano dots to the surface field enhancement effect. Using a simple hemispheriod model, we also obtained the enhancement factor of ZnSe nano dots.

Keywords: THz radiation, surface field enhancement, surface nano-dot, ZnSe.

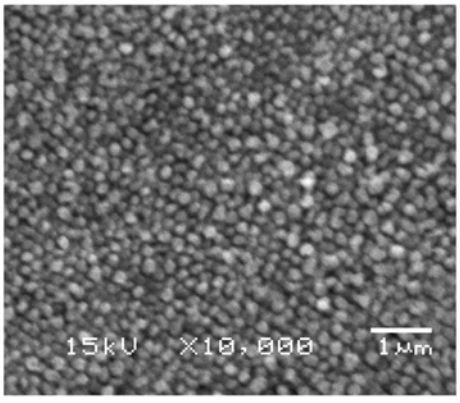

Fig. 1. SEM micrograph of ZnSe nano-dots.

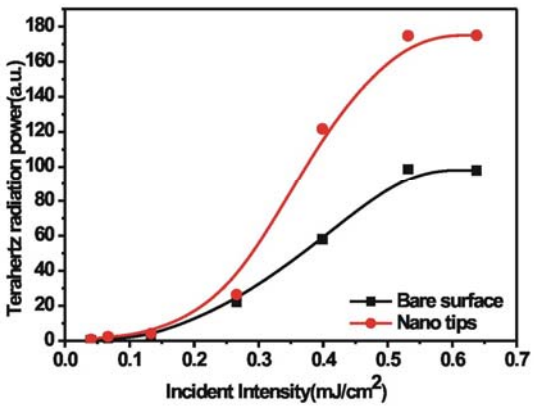

Fig. 2. THz fluence as a function of pump fluence for nano-dot and bulk ZnSe samples.