

## Preparation of ZnO phosphors by a new technique

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**Abstract.** Photo and electroluminescent properties of ZnO phosphors prepared by burning zinc in an atmosphere of pure oxygen have been reported. The peak positions obtained by resolving the experimental curves into Gaussian profiles are explained by assuming that the rare earths form the donor levels while the acceptor levels cause the emission of undoped phosphors. Voltage dependence of electroluminescent brightness shows that the mechanism of excitation consists of acceleration-collision. Brightness waves at different concentrations of rare earths and frequency of excitation are also studied and discussed.

**Keywords.** ZnO phosphors; photoluminescence; electroluminescence.

### 1. Introduction

ZnO phosphors show emission in different regions under different preparative conditions (Lehmann 1968): (i) the near-edge emission at about 3.18-3.20 eV at room temperature when it is *n*-doped and prepared under reducing atmosphere (Lehmann 1966), (ii) the common green emission band whose origin is still a matter of controversy (Smit and Kröger 1949; Thomson 1950; Lehmann 1968; Joshi and Kumar 1973; Bhushan *et al* 1979a,b), (iii) a yellow-orange band appearing in the presence of either selenium (Markowski and Orshanskaya 1960; Miller 1954) or excess oxygen (Joshi and Kumar 1973; Bhushan and Asare 1980a) and (iv) a red to infrared band which appears in the presence of NH<sub>3</sub> (Lehmann 1968) and is due to transition between the edge of the conduction band to a hole trapped at 1.60 eV above the edge of the valence band (Lauer 1973). In all earlier investigations ZnO was used as a starting material for preparing such phosphors. We have investigated undoped and rare earth doped ZnO phosphors prepared by a new method. These phosphors are found to be more efficient compared to those prepared by the other method (Bhushan *et al* 1979a; Bhushan and Asare 1980a). The present paper reports some photo (PL) and electroluminescent (EL) studies of ZnO phosphors prepared by this new method.

### 2. Experimental procedure

The undoped phosphors were prepared by burning zinc metal (pure up to 10 ppm), procured from Johnson Matthey Chemicals, England, under continuous flow of 99.3% pure oxygen. The burning was done by suddenly rushing the silica boat con-