# Auto-combustion synthesis of pure and Er, Dy co-doped ZnO nanomaterials for efficient methyl orange degradation using solar and visible light photocatalysis

Pure and Er-Dy co-doped ZnO nanomaterials (EDZ) were synthesized using auto combustion method. The obtained materials were used as photocatalysts for methyl orange (MO) degradation by solar irradiation and visible light (*λ* > 420 nm). The synthesized materials were characterized by x-ray diffraction (XRD), scanning electron microscopy (SEM), Uv-visible diffuse reflectance spectroscopy (DRS), photoluminescence spectroscopy (PL) and cyclic voltammetry (CV) measurements. XRD revealed highly crystalline hexagonal wurtzite structures. The crystallite size enhanced with Er and Dy dopants. DRS analyses revealed that energy gap (Eg) values for doped (Er 2.5%-5%+ Dy 2.5%–5%) nanoparticles were in the range 3.16–3.20 eV, showing a decreasing trend with increasing dopant concentrations. The CV measurements showed enhanced conductivity of doped nanomaterials than pure ZnO. The best photocatalytic activity was demonstrated by nanomaterials having the highest concentration of doping i. e. Zn0.90 Er0.05 Dy0.05O. The temperature dependent dielectric constant and tangent loss decreased with applied frequency for all prepared materials in general.