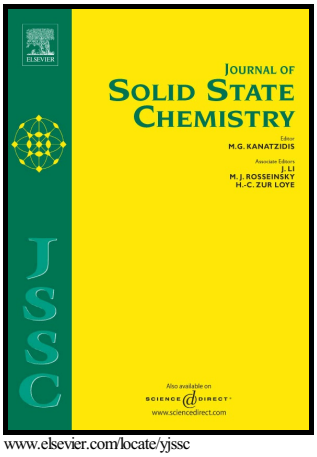

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Yb^{3+}-doped cadmium molybdato-tungstate single crystal – its structural, optical, magnetic and transport properties

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ABSTRACT

Single crystal of new cadmium and ytterbium molybdato-tungstate ($Cd_{0.9706}\square_{0.0098}Yb_{0.0196}(MoO_4)_{0.9706}(WO_4)_{0.0294}$, where □ denotes cationic vacancies) has been successfully grown by the Czochralski method in air and under 1 MPa. X-ray crystallographic analysis reveals that the as-grown single crystal belongs to a scheelite-type structure (a = b = 5.15539(12) and c = 11.1919(3) Å, space group $I4_1/a$), in which Yb^{3+} ions do not show long-range order and are randomly distributed in the unit cell, substituting the Cd^{2+} ones. The as-grown single crystal does not show anisotropy of optical properties, *i.e.* its direct band gap reaches E_g = 1.76 or 1.75 eV along (*100*) and (*001*) crystallographic directions, respectively. The single crystal exhibits paramagnetic state with short-range antiferromagnetic and long-range ferrimagnetic interactions, a magnetization with zero coercivity and, a remanence that is almost a universal function of H/T, characterizing superparamagnetic-like behaviour. Electrical studies of the new ytterbium-doped cadmium molybdato-tungstate single crystal show a relatively small dielectric constant ($\varepsilon_r < 12$), large lossiness of Joule-Lenz type observed at low frequencies as well as nonlinear *I-V* characteristics of Schottky or Maxwell-Wagner type.

Graphical abstract

Single crystal of new cadmium and ytterbium molybdato-tungstate ($Cd_{1-3x}\square_xYb_{2x}(MoO_4)_{1-3x}(WO_4)_{3x}$, where □ denotes cationic vacancies and x = 0.0098) has been successfully grown by the Czochralski method using high-pressure of air. Its optical, magnetic and dielectric properties were investigated in detail.

Keywords: Scheelite; Czochralski method; Crystal structure; UV-vis; Magnetic properties; Dielectric studies.

1. Introduction