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#### ACCEPTED MANUSCRIPT

# Yb<sup>3+</sup>-doped cadmium molybdato-tungstate single crystal – its structural, optical, magnetic and transport properties

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#### **ABSTRACT**

molybdato-tungstate Single cadmium and ytterbium crystal new  $(Cd_{0.9706}\square_{0.0098}Yb_{0.0196}(MoO_4)_{0.9706}(WO_4)_{0.0294}$ , where  $\square$  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<sup>2+</sup> 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  $(Cd_{1-3x}\Box_x Yb_{2x}(MoO_4)_{1-3x}(WO_4)_{3x}$ , where  $\Box$  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

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