New electrically conductive oxide glass

T. Nishida

Faculty of Humanity-Oriented Science and Engineering,
Kinki University, Kayanomori 11-6, Iizuka 820-8555, Japan

Abstract: New electrically conducting glass with a registered trade mark of *NTA glass*™ (2006) has an electric resistivity (□ ranging from 10^0 to 10^7 Ωcm at room temperature. Typical *NTA glass*™ is composed of BaO, V_2O_5 and Fe_2O_3 [1]. Semiconductivity of common vanadate (V_2O_5-basesd) glasses is known to be due to a step-by-step 3d electron (small polaron) hopping from tetravalent (V^{IV}) to pentavalent vanadium (V^V) [2]. Heat treatment of *NTA glass*™, $15BaO \cdot 70V_2O_5 \cdot 15Fe_2O_3$, at a temperature less than crystallization temperature (T_c) resulted in a drop of □ from 10^7 to 2300 Ωcm [3]. As a result of heat treatment at a temperature higher than T_c, □ of $20BaO \cdot 70V_2O_5 \cdot 10Fe_2O_3$ glass dropped from 10^6 to 10^0 Ωcm [4].

Mössbauer spectroscopy of oxide glass containing Fe^{III} [5,6] is very useful for determining the local symmetry or distortion of FeO_4 tetrahedra and that of VO_4 tetrahedra, since these structural units are linked to each other by sharing corner oxygen atoms. Mössbauer spectra of heat-treated *NTA glass*™ [3,4] proved a structural relaxation of the network, *i.e.*, an increased local symmetry of VO_4 and FeO_4 tetrahedra, resulting in an increased probability of the electron hopping from V^{IV} to V^V.

NTA glass™ will have several industrial applications such as cathode active material for lithium-ion battery [7], electron-emitting needle for "ionizer". It is anticipated that *NTA glass*™ is successfully applied in the field of nanotechnology, *e.g.* as hyperfine processing material with focused-ion beam (FIB), electrons, lasers, *etc*.

Author, E-mail: nishida@fuk.kindai.ac.jp

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