THE EBSD MICROTEXTURAL ANALYSIS OF NATURAL AGGREGATE OF IRON OXIDES EXPERIMENTALLY DEFORMED WITH 6 PISTON MULTI-ANVIL PRESS

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ABSTRACT: Magnetite (Fe_3O_4) and hematite (Fe_2O_3) are important mineral constituents of iron formations, being the main phases of iron deposits worldwide, such as those in the Quadrilátero Ferrífero region – Brazil, as well as common accessory minerals in many igneous and sedimentary rocks. The understanding of the effects of deformation on magnetite grains, their transformation into hematite and the textural aspects involved are, therefore, very important for understanding the processes of formation and deformation of these rocks. The analyzed micro textures developed in natural aggregate of magnetite with small amounts of hematite and quartz that was experimentally deformed under the confining pressure of 3GPa and temperatures between 900 ˚C – 1100 ˚C, in a pure shear configuration using a 6 piston Multi anvil press from the Bayerisches Geoinstitute (BGI), Germany. Five experiments were performed with strain rates varying between $5x10^{-5}$ s^{-1} and 8.3 $x10^{-5}$ s^{-1}. The recovered samples were studied by Electron Back Scatter Diffraction (EBSD) technique. The EBSD data were processed and analyzed using the Mtex toolbox and Channel 5 processing software. The aims of the study were to observe the micro textures developed in the magnetite and hematite grains, as well as the influence of the deformation and temperature on the transformation between these oxides. Results show that the transformation of magnetite into hematite occurs at all imposed conditions. Hematite is more abundant at temperatures around 900˚-1000˚C in samples deformed under the strain rate of 8.3 $x10^{-5}$ s^{-1}. Both iron oxide phases deformed plastically by dislocation creep. Magnetite developed a quasi-single crystal CPO while hematite shows fiber texture in most of experiments. The slip systems {111}<110>, {100}<110> and {110}<110> are inferred to be active during magnetite deformation, and for hematite the <a>(c) slip system and the 60˚<c> twin seem to be responsible for the observed CPO patterns. A topotaxial relationship between magnetite and hematite is shown by the pole figures, but the boundary misorientation relationship of 60˚<0001>hematite // 60˚<111>magnetite is absent. Besides, the micro textural analysis of these iron oxides can contribute to further investigations on high temperature and high pressure phases such as ringwoodite and akimotoite once they present crystallographic similarities with magnetite and hematite respectively.

KEY WORDS: IRON OXIDES, EBSD, EXPERIMENTAL DEFORMATION.