CHARACTERIZATION OF Fe-Ni-BEARING METEORITES BY SYNCHROTRON X-RAY DIFFRACTION.

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Fe-Ni-bearing meteorites contain very unique minerals due to their formation at very slow cooling rates. Some of these minerals have similar lattice parameters, only differing in the formation of superlattice patterns or in their composition. This differentiation is hard to achieve with conventional X-ray diffraction equipments and commonly-used exposure times. In particular, the coexistence of the ordered Fe-Ni phase, Tetrataenite (L_{10}) with disordered paramagnetic Fe-rich phase, Antitaenite, previously proposed based on Mössbauer evidence [1], but never unambiguously observed by a diffraction method.

This paper reports the results of Synchrotron X-ray diffraction investigation of iron meteorites carried out at the *Laboratório Nacional de Luz Sincrotron* (Campinas, Brazil). The goniometer was used in Bragg-Brentano geometry, with divergence and scattering slits (1.5 mm) and a 1 mm width receiving slit. The X-ray wavelength was chosen to be 0.174565 nm (7102.5 ± 2.5 eV), a value which is near the minimum scattering power of Fe, to increase the scattering power difference between iron and nickel. The LaB_6 NIST standard (660a) was used to check the angular position and to evaluate the instrumental profile. X-ray diffraction data were analyzed using the TOPAS 3.0 Rietveld program [2] and the fundamental parameters approach.

The results for the Santa Catharina meteorite confirmed for the first time the presence of a disordered face centered cubic phase (FCC), space group Fm-3m, with stoichiometry $Fe_{0.6665}Ni_{0.3335}$ and lattice parameter of 0.3588 nm. This phase agrees with the previously proposed paramagnetic antitaenite [1]. The other two Fe-Ni phases were an ordered phase and iron-deficient Tetrataenite ($Fe_{0.4356}Ni_{0.5644}$) and a disordered phase, face centered cubic, with almost the same composition as the ordered phase ($Fe_{0.4385}Ni_{0.5615}$). The relative amounts of these phases are 44.6 wt% Tetrataenite, 48.9 wt% Antitaenite and 6.5 wt% disordered FCC phase. Results for other meteorites will also be reported.

References: [1] D. G. Rancourt and R. B. Scorzelli, Journal of Magnetism and Magnetic Materials 150, 30-36 (1995). [2] TOPAS 3.0 Technical Reference Manual, Bruker AXS, Karlsruhe, 2005.