A NEW PROMISING NANOSIMS METHOD OF STUDYING ^{60}FE-^{60}NI SYSTEM IN METEORITES. S. Mostefaoui and M. Bourot-Denise. Muséum National d'Histoire Naturelle. LMCM UMR CNRS –7202. Case 52, 57 Rue Cuvier 75321 Paris Cedex 05. E-mail: smail@mnhn.fr.

Introduction: Studies of ^{60}Fe-^{60}Ni in primitive meteorites revealed the importance of this chronometer to constrain early solar system events and initial ^{60}Fe/^{56}Fe ratio [1-5]. The SIMS measurements of in situ mineral phases with high Fe/Ni ratios such as silicates and troilite [1,4] show evidence of ^{60}Ni-excess attributed to the decay of ^{60}Fe. However, as Ni isotopes are measured as positive secondary ions using a primary O^- beam, technical problems, e.g. low Ni ion yields, large beam size, cratering effects are real limitations. This made it difficult to get, under reasonable analytical conditions, precise Ni isotopic ratios. Here, we present the first NanoSIMS study using primary Cs^+ ions to access high-precision/high-spatial-resolution Ni isotopic ratios of metal and troilite standards; chondrite measurements are in progress.

Experiment: In situ isotopic measurements were conducted with the NanoSIMS-50 using a primary Cs^+ of ~10-40pA on sample surface. Negative secondary ions of $^{56}Fe^-$, $^{60}Ni^-$ and $^{62}Ni^-$ were simultaneously measured in a multi-detection mode at HMR ~7000-10000, sufficient to separate isobaric interferences. For ^{62}Ni, despite its peak-to-peak resolution with ^{46}TiO we found as in previous studies [2] the tail of ^{46}TiO can contribute to the ^{62}Ni signal. This effect is measured in a Ni-free rutile (TiO_2) in which a count rate of 27cps at ^{60}Ni peak position corresponds to the tail of ^{46}TiO. We verified the metal and troilite we measured have no ^{46}TiO interference at the ^{62}Ni mass region.

Results: Thin sections of a synthetic metal (Ni=30.5wt%), NBS-663 (Ni=0.32wt%) and a Canyon-Diablo troilite (Ni=0.08wt%) were prepared for NanoSIMS. Using Cs^+, the ion yield for Ni is clearly improved. The sensitivities of Ni on metal (~120cps/nA/ppm) and troilite (~10cps/nA/ppm) are high by factors of ~3 and of ~100 respectively relative to what we obtained using O^- [2,5]. The average δ^{60}Ni value of 12 CD troilite spots (1h measurement each) relative to the metal standard is essentially zero with a 2 sigma error of ~5‰. Under these conditions we achieved a spot size of less than 1µm, representing an improvement of the spatial resolution by at least a factor of 5 compared to previous studies using O- [2-5]. The Fe/Ni relative sensitivity factor is ~60 times higher in favor of Fe for the CD troilite than for the metal standards. Reproducibility for the Fe/Ni ratio is about 9% in the metallic standards while it is about 40% in the CD troilite suggesting a probably microscopic heterogeneity in the troilite.

Discussion: The present preliminary results show that the Fe-Ni system is better studied using Cs^+ than using O^-. At least two advantages are in favor of the Cs^+ study: 1- The Ni sensitivity is higher and thus a higher precision of Ni isotopic ratios can be achieved. 2- The possibility of decreasing the spot size to 1µm opens a new way of measuring small mineral phases that are not accessible using primary O^-. Continuing improvements as well as measurements of chondritic troilite are now in progress.

References: [1] Shukolyukov, A., & Lugmair, G. W. 1993, Science, 259, 1138. [2] Mostefaoui S. et al 2005. Astrophys. J. 625:271-277. [3] Tachibana S. & Huss G. R. 2003. Astrophys. J. 588:L41-L44. [4] Tachibana et al. 2006. Astrophys. J. 639:L87-L90. [5] Mostefaoui et al. 2004. *New Astron. Rev.*, **48**, 155–159.