5100

STUDY OF METAL EXTRACTED FROM TZAREV L5 CHONDRITE BY MÖSSBAUER SPECTROSCOPY AND METALOGRAPHY

E. V. Zhiganova and M. I. Oshtrakh. Faculty of Physical Techniques and Devices for Quality Control, Ural State Technical University–UPI, Ekaterinburg, 620002, Russian Federation. E-mail: evgeniya@dpt.ustu.ru, oshtrakh@mail.utnet.ru

Introduction: Mössbauer spectra of ordinary chondrites consist of several components related to metal, troilite, olivine, pyroxene, and iron oxides. The area of metal subspectra does not exceed 20% and this value is related to the metal iron content. Usually chondrite metal contains more than one metal phase, but they cannot be resolved in complicated Mössbauer spectrum of chondrite sample [1, 2]. Therefore, metal extraction from meteorite matter is necessary for detailed study by Mössbauer spectroscopy.

Methods: A sample of metal extracted from ordinary chondrite Tzarev L5 was prepared as powder and glued on pure aluminum foil. Extraction was performed by several steps: powdering, levigation in acetone followed by the separation in strong and weak magnetic fields, then drying and etching by weak HF, and final selection with binocular loupe from silicates. Mössbauer spectrum was measured at room temperature using spectrometer SM-2201 with high accuracy, stability, and sensitivity in transmission geometry with moving absorber. Sections of Tzarev L5 for metallography were polished with diamond paste and etched by Nital (2 vol% HNO_3, balance ethyl alcohol). Chemical composition of metal was obtained by microanalysis EDAX realized on SEM.

Results: Mössbauer spectrum of metal from Tsarev L5 was measured with high velocity resolution using 4096 channels and than presented in 1024 channels for fitting. The results of the spectrum better fit demonstrated the presence of three sextets with the hyperfine field values related to kamacite α-Fe(Ni,Co), martensite α_2-Fe(Ni,Co) and kamacite α'-Fe(Ni,Co), one doublet related to residue olivine, and one singlet related to taenite γ-Fe(Ni,Co). The result of the metal grains metallography demonstrates the presence of various metal phases: α-Fe(Ni,Co), α_2-Fe(Ni,Co), and both α'-Fe(Ni,Co) and γ-Fe(Ni,Co) in plessite.

Conclusions: Study of extracted metal from Tzarev L5 by Mössbauer spectroscopy permitted us to reveal four different metal phases and determine its hyperfine parameters and relative areas. These results were in good agreement with metallography data.

References: [1] E. V. Zhiganova et al. 2005. *Meteoritics & Planetary Science* 40:A174. [2] E. V. Zhiganova et al. *Hyperfine Interactions.* Forthcoming.

5144

Si AND C ISOTOPIC RATIOS IN AGB STARS: SiC GRAIN DATA, MODELS, AND THE GALACTIC EVOLUTION OF THE Si ISOTOPES

E. Zinner[1], L. R. Nittler[2], R. Gallino[3, 7], A. I. Karakas[4], M. Lugaro[5], O. Straniero[6], and J. C. Lattanzio[7]. [1]Washington University, Saint Louis, Missouri 63130, USA. E-mail: ekz@wustl.edu. [2]Carnegie Institution of Washington, NW Washington, D.C. 20015, USA. [3]Università di Torino, Italy. [4]McMaster University, Hamilton, Ontario, L8S 4M1, Canada. [5]University of Utrecht, 3508 TA Utrecht, The Netherlands. [6]INAF, Osservatorio Astronomico di Teramo, Italy. [7]Monash University, Victoria 3800, Australia

Presolar grains of the mainstream, Y and Z type are believed to have an origin in carbon stars. We compared the C and Si isotopic ratios of these grains [1] with the results of theoretical models for the envelope compositions of AGB stars. Two sets of models (FRANEC, Monash) use a range of stellar masses (1.5 to 5 $M_{\odot}$), metallicities, different prescriptions for mass loss, and two sets of neutron-capture cross-sections for the Si isotopes [2, 3]. They predict that the shifts in Si isotopic ratios and the increase of $^{12}C/^{13}C$ in the envelope during third dredge-up are higher for higher stellar mass, lower metallicity, and lower mass loss rate. The Guber et al. [3] cross-sections result in larger shift in the $^{30}Si/^{28}Si$ ratios and smaller shifts in the $^{29}Si/^{28}Si$ ratios than the Bao et al. [2] cross-sections. Because the ^{22}Ne neutron source dominates Si nucleosynthesis, the effect of the ^{13}C source is negligible.

Comparison of the model predictions with grain data confirms an AGB origin for mainstream, Y, and Z grains, with the first type coming from stars with solar metallicity [4], the rest from stars with lower-than-solar metallicity [1, 5, 6]. The Si isotopic ratios of the Z grains favor the more recent Guber et al. [3] cross-sections. The $^{12}C/^{13}C$ ratios of low-metallicity models are much higher than those found in Z grains and cool bottom processing [7] must be invoked to explain the grains' C isotopic ratios. The high predicted C/O ratios in low-metallicity stars not experiencing this process might have prevented the formation of SiC and led to the condensation of graphite instead [8]. By combining Z grain Si data with the models we determined the evolution of the $^{29}Si/^{28}Si$ ratios in the Galaxy as function of metallicity Z (Fig. 1). At $Z < 0.01$ this ratio rises much faster than current Galactic evolution models [9] predict and suggest an early source of the heavy Si isotopes not considered in these models, which are mainly based on type II supernova nucleosynthesis.

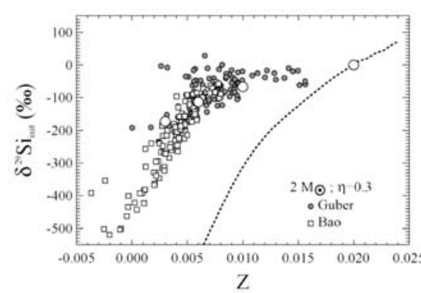

Fig. 1. Predicted evolution of $^{29}Si/^{28}Si$ as function of metallicity based on Z grains and the FRANEC models of a 2 $M_{\odot}$ star with Reimers mass loss η of 0.3 and two sets of Si cross-sections. This evolution is compared with the GCE model of Timmes and Clayton [9] (dotted line). The large open circles are the ratios assumed in our theoretical models.

References: [1] Nittler L. R. and Alexander C. M. O'D. 2003. *Geochimica et Cosmochimica Acta* 67:4961. [2] Bao Z. Y. et al. 2000. *Nucl. Data Tables* 76:70. [3] Guber K. H. et al. 2003. *Physical Review C* 67: 062802-1. [4] Hoppe P. and Ott U. 1997. In *Astrophysical implications of the laboratory study of presolar materials.* New York: AIP. p. 27. [5] Hoppe P. et al. 1997. *The Astrophysical Journal* 487:L101. [6] Amari S. et al. 2001. *The Astrophysical Journal* 546:248. [7] Nollett K. M. et al. 2003. *The Astrophysical Journal* 582:1036. [8] Jadhav M. et al. *New Astronomy Reviews.* Forthcoming. [9] Timmes F. X. and Clayton D. D. 1996. *The Astrophysical Journal* 472:723.