### Accepted Manuscript

Iron and nickel isotope compositions of presolar silicon carbide grains from supernovae

János Kodolányi, Thomas Stephan, Reto Trappitsch, Peter Hoppe, Marco Pignatari, Andrew M. Davis, Michael J. Pellin

PII:	\$0016-7037(17)30314-9
DOI:	http://dx.doi.org/10.1016/j.gca.2017.05.029
Reference:	GCA 10298
To appear in:	Geochimica et Cosmochimica Acta
Received Date:	1 December 2016
Revised Date:	16 May 2017
Accepted Date:	20 May 2017
To appear in: Received Date: Revised Date: Accepted Date:	Geochimica et Cosmochimica Acta 1 December 2016 16 May 2017 20 May 2017



Please cite this article as: Kodolányi, J., Stephan, T., Trappitsch, R., Hoppe, P., Pignatari, M., Davis, A.M., Pellin, M.J., Iron and nickel isotope compositions of presolar silicon carbide grains from supernovae, *Geochimica et Cosmochimica Acta* (2017), doi: http://dx.doi.org/10.1016/j.gca.2017.05.029

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## ACCEPTED MANUSCRIPT

1	Iron and nickel isotope compositions of presolar silicon carbide grains from
2	supernovae
3 4	János Kodolányi <sup>1</sup> *, Thomas Stephan <sup>2,3</sup> , Reto Trappitsch <sup>2,3,4</sup> , Peter Hoppe <sup>1</sup> , Marco Pignatari <sup>4,5</sup> , Andrew M. Davis <sup>2,3,6</sup> , Michael J. Pellin <sup>2,3,6,7</sup>
5	
6 7	<sup>1</sup> Max Planck Institute for Chemistry, Hahn-Meitner-Weg 1, 55128 Mainz, Germany <sup>2</sup> Chicago Center for Cosmochemistry
8 9	<sup>3</sup> Department of the Geophysical Sciences, The University of Chicago, 5734 S Ellis Ave, Chicago, IL 60637, USA <sup>4</sup> The NuGrid Collaboration (http://www.nugridstars.org)
10	<sup>5</sup> E. A. Milne Centre for Astrophysics, University of Hull, Hull, HU6 7RX, UK
11	<sup>6</sup> Enrico Fermi Institute, The University of Chicago, Chicago, IL 60637, USA
12	<sup>7</sup> Materials Science Division, Argonne National Laboratory, Argonne, IL 60439, USA
13	
14	*Corresponding author
15	Phone: +49 6131 305 5311
16	Fax: +49 6131 305 5004
17	Email: j.kodolanyi@mpic.de
18	ABSTRACT
19	We report the carbon, silicon, iron, and nickel isotope compositions of twenty-five presolar SiC
20	grains of mostly supernova (SN) origin. The iron and nickel isotone compositions were measured with

20 grains of mostly supernova (SN) origin. The iron and nickel isotope compositions were measured with 21 the new Chicago Instrument for Laser Ionization, CHILI, which allows the analysis of all iron and nickel 22 isotopes without the isobaric interferences that plagued previous measurements with the NanoSIMS. 23 Despite terrestrial iron and nickel contamination, significant isotopic anomalies in <sup>54</sup>Fe/<sup>56</sup>Fe, <sup>57</sup>Fe/<sup>56</sup>Fe, <sup>60</sup>Ni/<sup>58</sup>Ni, <sup>61</sup>Ni/<sup>58</sup>Ni, <sup>62</sup>Ni/<sup>58</sup>Ni, and <sup>64</sup>Ni/<sup>58</sup>Ni were detected in nine SN grains (of type X). 24 25 Combined multi-isotope data of three grains with the largest nickel isotope anomalies (>100 ‰ or 26 <-100 ‰ in at least one isotope ratio, when expressed as deviation from the solar value) are 27 compared with the predictions of two SN models, one with and one without hydrogen ingestion in 28 the He shell prior to SN explosion. One grain's carbon-silicon-iron-nickel isotope composition is 29 consistent with the prediction of the model without hydrogen ingestion, whereas the other two 30 grains' isotope anomalies could not be reproduced using either SN models. The discrepancies 31 between the measured isotope compositions and model predictions may indicate element 32 fractionation in the SN ejecta prior to or during grain condensation, and reiterate the need for three-33 dimensional SN models.

34

#### 35

#### 1. INTRODUCTION

Silicon carbide (SiC) is the most thoroughly studied presolar phase (e.g., Zinner, 2014). The isotope
 composition of major elements carbon and silicon, and the minor element nitrogen are used to
 distinguish between different origins of presolar SiC grains. SiC grains belonging to the "Mainstream"

(MS), Y, and Z groups formed in the winds of low-mass (1.5–3 M<sub>☉</sub>) asymptotic giant branch (AGB)
stars of different metallicities (e.g., Lugaro et al., 2003; Zinner et al., 2006), whereas the sources of
most grains of types A and B are probably J-type carbon stars and post-AGB stars (Hoppe et al., 1994;
Amari et al., 2001a). Based on their silicon isotope compositions and on the evidence for the initial
presence of <sup>44</sup>Ti in many of them, presolar SiC grains of types X and C are thought to have condensed
in the ejecta of type II core collapse supernovae (SNe; Amari et al., 1992; Hoppe et al., 2000; Croat et

45 al., 2010).

Download English Version:

# https://daneshyari.com/en/article/8910988

Download Persian Version:

https://daneshyari.com/article/8910988

Daneshyari.com