Quantitative trace element studies have been carried out on bulk SiC fractions \([1, 2]\) and individual presolar SiC grains \([e.g., 3 – 6]\). Amari et al. \([3]\) compared trace element abundance patterns in SiC grains to results of condensation calculations for circumstellar environments \([7]\) in order to associate grains with different C-rich stellar environments. Very few published studies attempt to quantify the abundance and distribution of trace elements in presolar graphite grains. Isotopic & TEM studies indicate lower trace element abundances compared to presolar SiC grains \([e.g., 8 – 13]\).

Low density (LD) graphite depictions accommodate trace elements in their structure. Each grain is known to contain abundant TiC subgrains (~2400 ppm) and Mg, Al, Si, Ca – incorporated in parent graphite crystallization. Zr, Ru, Mo, Fe, and Ni – concentrated within early crystallizing subgrains. Low density (LD) graphite depicts accommodate trace elements in their structure. Each grain is known to contain abundant TiC subgrains (~2400 ppm) and Mg, Al, Si, Ca – incorporated in parent graphite crystallization. Zr, Ru, Mo, Fe, and Ni – concentrated within early crystallizing subgrains.

Experimental details

- 13 LD Orgueil graphite (OR1d; \(\rho \approx 1.75 \times 1.92 \, \text{g cm}^{-3}\); diameters = 5 – 11 \(\mu\text{m}\))
- Cameca ims 1280 ion microprobe at the University of Hawai’i
  - Scanning ion images in a combination of multi-collection & peak-jumping mode
  - 50-60 pA O\(^+\) primary beam focused to ~1 \(\mu\text{m}\), rastered over 12x12 \(\mu\text{m}^2\) regions
  - Stage 1: \(36\), \(90\), \(86\), \(12\), \(18\), \(28\), \(15\)
  - Stage 2: \(44\), \(51\), \(47\), \(54\), \(60\), \(25\), \(22\), \(38\), \(32\)
  - Cs\(^+\) primary beam: C, N, and Si isotopes
  - \(\rho\) flooding used to increase ion yield
  - Measured synthetic SiCs and USGS24 as standards
  - Image used for data reduction

\(\delta^44\)Si

- 6 out of 13 grains have \(26\)Si and/or \(28\)N excesses
- 36% of LD graphite have \(26\)Si excesses, and high inferred \(26\)Al/\(28\)Al & \(44\)Ti/\(48\)Ti ratios

Future perspectives

- Standardization
  - Absolute elemental abundances
  - Enrichment & depletion relative to chondritic values
  - Enrichment & depletion relative to SiC abundances \(\rightarrow\) compare chemistry of circumstellar environments of SiCs and graphite
  - Provide abundance estimates for measurements with CHILI

- Examine evidence for contamination

References