THE ^{13}C-POCKETS IN AGB STARS AND THEIR FINGERPRINTS IN MAINSTREAM SIC GRAINS

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The main *s*-process occurs in AGB stars, with $^{13}C(\alpha,n)^{16}O$ being the major neutron source [1], but it is unclear what process(es) are responsible for mixing protons from the bottom of the convective envelope to the He-intershell to form the so-called ^{13}C pocket. AGB model predictions suffer from uncertainties in the distribution of ^{13}C within and the mass of the ^{13}C-pocket [2]. We investigated ^{13}C-pocket internal structures with Torino postprocess AGB nucleosynthesis models in an attempt to match isotopic compositions of mainstream presolar SiC grains. We found that predictions of $^{88}Sr/^{86}Sr$, $^{92}Zr/^{94}Zr$, and $^{138}Ba/^{136}Ba$ are extremely sensitive to the ^{13}C profile and ^{13}C-pocket mass [3,4]. Better agreement with mainstream SiC can be obtained by adopting a ^{13}C-pocket with a flat ^{13}C profile, compared to the decreasing-with-depth profile previously used. However, we could not exclude the possibility of diverse ^{13}C-pockets in parent AGB stars based on only $^{138}Ba/^{136}Ba$ or $^{92}Zr/^{94}Zr$ data in mainstream SiC. We therefore measured Sr and Ba isotopes in mainstream SiC grains simultaneously. Using a four-isotope plot of $^{88}Sr/^{86}Sr$ versus $^{138}Ba/^{136}Ba$, we showed that parent AGB stars of mainstream SiCs tend to have lower-mass ^{13}C-pockets with both flat and decreasing-with-depth ^{13}C profiles [5].

[1] Gallino et al., ApJ 497, 388 (1998).
[2] Bisterzo et al., ApJ, accepted (2014).
[3] Liu et al., ApJ, accepted (2014).
[4] Liu et al., ApJ, submitted (2014).
[5] Liu et al., LPS 45, #2049 (2014).