REVISITING THE CAI OXYGEN ISOTOPE ANOMALY.
M. Ozima[1], A. Yamada[1], O. Abe[2], S. Nanbu[3], and Y. Kasai[4]. [1]U. of Tokyo, Tokyo 113-0033, Japan. [2]U. of Nagoya, Nagoya 464-8601, Japan, [3]Sophia U., Tokyo 102-8554, Japan, [4]NICT, Tokyo 184-8791, Japan.

Motivation: Mass-independently fractionated oxygen isotopes in CAI [1] are widely assumed to be due to self-shielding (hereafter SS) of CO in early solar environments [e.g. 2]. However, the SS process necessarily leads to an unusual prediction that a mean solar oxygen isotopic composition differs from most of planetary bodies, but is close to a typical CAI oxygen. The latest results of the Genesis mission failed to confirm the prediction [3]. Ozima et al. [4] concluded from statistical analyses of meteorite oxygen isotope data that solar oxygen must essentially be the same as those of planetary objects. Experiments by Chakraborty et al. [5] showed that SS of CO had little role in producing the mass independent isotopic fractionation of O, but a quantum mechanical process is more important. These recent developments lead us to reexamine a SS hypothesis.

Self shielding hypothesis: From a Beer-Lambert photo-attenuation law, we show that unless photo-dissociation rates are identical in C17O and C18O (only possible in an extremely fortuitous condition), SS-induced oxygen does not lie on a slope = 1.0 line in a 17O - 18O plot, which is generally regarded to characterize CAI oxygen. Considerable difference in photo-dissociation rates between C17O and C18O is also implied from quantum mechanical calculation [Yamada et al. this volume].

SW-oxygen: Although Genesis results do not support the prediction of SS scenarios, we need to explain the observation that the captured SW-oxygen is enriched in 16O [3]. The enrichment may be attributed either to fractionation in SW or to an indigenous solar component. In this regards, we note that Griffith and Gellene [6] observed a large mass-independent isotopic fractionation of oxygen when a comparable amount of He, or Ar was mixed with O in mass spectrometric analyses. Abe and Yoshida [7] observed a similar effect not only with noble gases, but also with N2. We discuss the relevance of these experiments to oxygen isotopic fractionation of oxygen in SW.

Conclusions: Self-Shielding hypothesis does not explain a slope 1.0 linear trend of oxygen isotopic fractionation in a 17O - 18O plot. Process (es) other than SS should be sought for the origin of the anomalous CAI oxygen.

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