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## Temperature in Solar Sources of $^3\text{He}$ -rich Solar Energetic Particles and Relation to Ion Abundances

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$^3\text{He}$ -rich solar energetic particles (SEPs) are believed to be accelerated in solar flares or jets by a mechanism that depends on the ion charge-to-mass ( $Q/M$ ) ratio. It implies that the flare plasma characteristics (e.g., temperature) may be effective in determining the elemental abundances of  $^3\text{He}$ -rich SEPs. This study examines the relationship between the suprathermal ( $<0.2$  MeV nucleon $^{-1}$ ) abundances of the He–Fe ions measured on the Advanced Composition Explorer and temperature in the solar sources for 24  $^3\text{He}$ -rich SEP events in the period 2010–2015. The differential emission measure technique is applied to derive the temperature of the source regions from the extreme ultraviolet imaging observations on the Solar Dynamics Observatory. The obtained temperature distribution peaks at 2.0–2.5 MK that is surprisingly consistent with earlier findings based on in-situ elemental abundance or charge state measurements. We have found a significant anti-correlation between the  $^3\text{He}/^4\text{He}$  ratio and solar source temperature with a coefficient of  $-0.6$ . It is most likely caused by non-charge-stripping processes, as both isotopes would be fully ionized in the inferred temperature range. This study shows that the elemental ratios  $^4\text{He}/\text{O}$ ,  $\text{N}/\text{O}$ ,  $\text{Ne}/\text{O}$ ,  $\text{Si}/\text{O}$ ,  $\text{S}/\text{O}$ ,  $\text{Ca}/\text{O}$ ,  $\text{Fe}/\text{O}$  generally behave with temperature as expected from abundance enhancement calculations at ionization equilibrium. The C and Mg, the two species with small changes in the  $Q/M$  ratio in the obtained temperature range, show no such behavior with temperature and could be influenced by similar processes as for the  $^3\text{He}/^4\text{He}$  ratio.

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