

4 - 6 Fragmentation Dynamics of a Carbon Dioxide Dication Produced by Ion Impact*

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The three-body fragmentation of CO_2^{2+} to $\text{C}^+ + \text{O}^+ + \text{O}$ induced by 1 keV/u Ar^{2+} impact is investigated employing the Reaction microscope. Three different dissociation mechanisms are clearly identified, and their branching ratios are determined. The concerted fragmentation with two CO bonds breaking simultaneously is dominant (61.7%), while the sequential pathway with CO^+ as the intermediate also makes a significant contribution (36.6%). Also, a novel isomerization pathway with transitory formation of O_2^+ is identified (1.7%). No evidence of the sequential pathway with deferred charge separation is observed in our measurement, which is supported by the potential energy calculation. The KE distributions of three fragments for different pathways are obtained in our measurement. It was found that most of the measured O^+ KE is higher than the escape energy of oxygen in the Martian atmosphere of 1.9 eV (Fig. 1). Thus the mechanisms identified in the present study can contribute to the escape of O^+ from Martian atmosphere. Meanwhile, the two sequential fragmentation pathways may also contribute to escape of neutral O.

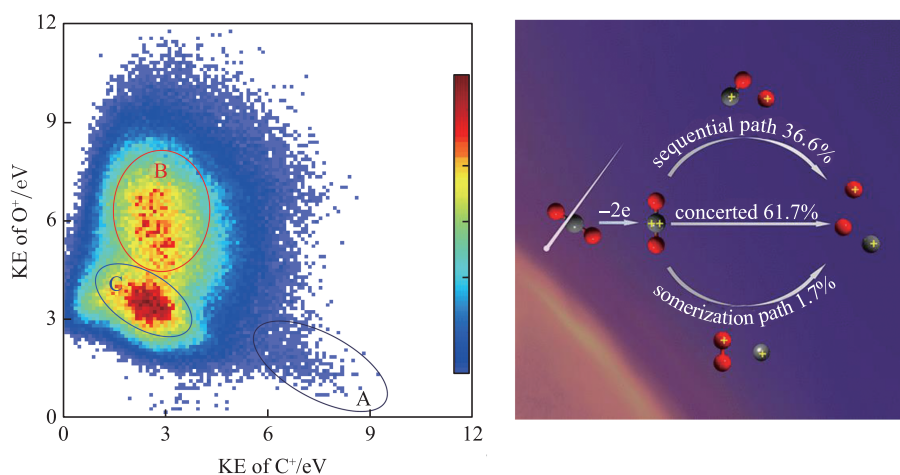


Fig. 1 (color online) The left panel displays the KE correlation between C^+ and O^+ . The structures in the black, red, and blue ovals arise from different fragmentation pathways: sequential pathway with isomerization (A), sequential pathway with initial charge separation(B), and concerted fragmentation pathway (C). These different pathways and their branching ratios are summarized in the right panel.

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