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Low-Temperature Graphitization of Amorphous Carbon

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Graphitization converted from carbonaceous materials is a process independent of pressure but strongly dependent on temperature. Meanwhile, the reaction of it is irreversible and records the highest temperature of graphite genesis. Therefore, it is a useful thermometer to widely determine the peak temperature of metamorphism in the terrains. The highest conversion temperatures to graphite in different metamorphic terrains were mainly estimated by the garnet-biotite Fe-Mg partitioning geothermometer, and oxygen and carbon isotopic and apatite fission track thermometers. The results of peak temperature is a linear relationship between temperature and the Raman parameter, which is measured by the Raman spectra with three Raman bands, D1, D2, and G ones. Meanwhile, graphitization has been reported in a slip zone of seismic faulting, e.g. 2008 Wenchuan earthquake to suggest graphite may not just be formed in traditional metamorphic conditions.

In this study, we apply amorphous carbon samples as starting materials and were treated at temperatures ranging from 500˚C to 900˚C, and the experimental time ranging from 1 to 6 hours in the laboratory. Each experiment was treated individually with a temperature and an experiment time in order to avoid deviation. Then, the SEM, Raman spectra analyzer and X-ray diffraction were applied to in-situ analyze the graphitization process starting from amorphous carbon. The results show when amorphous carbon samples were treated after 2 hours, in-situ analysis indicated that there was a linear relationship between temperatures and Raman R1 ratio (D1/G) as the temperature increase. However, this correlation seems not to preserve as much once it annealed to room temperature. The graphitization, therefore, might not record the highest temperature and a portion of graphite may be reversible after cooling.