**In-situ TEM Observation of Zipper-like Wall-to-Wall Coalescence of Double-wall Carbon Nanotubes with Home-made Very High Temperature Compatible Heating Holder**

Sihan Zhao¹, Ryo Kitaura¹, Yasumitsu Miyata¹ and Hisanori Shinohara¹

¹ Department of Chemistry & Institute for Advanced Research, Nagoya University, Nagoya 464-8602, Japan (r.kitaura@nagoya-u.jp or noris@cc.nagoya-u.ac.jp)

We report, for the first time, the detailed in-situ TEM observation of wall-to-wall coalescence [1, 2] of Double-wall carbon nanotubes (DWCNTs) at very high temperature (>2000°C). Such observation is enabled by developing a home-made and very high temperature compatible TEM specimen heating holder equipped with a micro-sized carbon nanotubes (CNTs) network heater. This micro-sized CNT heater could reliably meet the necessity of sample heating to sufficiently high temperature (up to 3000°C) while minimizing spatial drift of sample induced by the heating.

We observed that a single larger-diameter DWCNT is formed at the final stage through a zipper-like mechanism of wall-to-wall coalescence between two individual outer shells and two individual inner shells. The time sequential TEM images obtained throughout the reaction suggests the presence of the Stone-Wales type transformation, which provides insight on thermal reconstruction process of the nanocarbon materials.