Polymer materials studied by SAXS/WAXS at SSRF

Feng Tian, Jie Wang

Shanghai Institute of Applied Physics, Chinese Academy of Sciences,

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It is hard to study the dynamic structure changes of polymer materials due to its high molecular weight and complex inner structure. now, we will take polytetrafluoroethylene (PTFE) and fibers for example.

(1) PTFE will be cracked when it was irradiated by γ -ray directly. It could be prepared ultrafine powder which is used as lubricant and easer, etc. While, PTFE will be cross-linked by electron beam irradiation in the molten state in an oxygen-free atmosphere. Compared with PTFE, the mechanical properties of cross-linked PTFE improved significantly, and extended its industrial application fields. The analysis of the change of the inner structure of irradiated polymer play an important role in irradiation technology[1].

(2) The characterization technique of fibers has been a research emphasis for its complex inner structure. We must choose statistical method to study a large number of fibers and different part of fibers[2].

Small angle X-ray scattering (SAXS) is a non-destructive technique which could test the inner scale between several nanometers and several hundred nanometers. It is mainly used to analysis the scale, morphology, crystalline and amorphous of the scatterer. So, SAXS is an ideal method to study the change of irradiated polymer and the inner structure of fibers. Now the third generation synchrotron radiation light source with its high flux density, providing a strong instrument for SAXS study of polymer.

^[1] Tian Feng, Tang Zhongfeng, Xu Hongjie, Wang Jie, Wu Guozhong, Li Xiuhong. SAXS Studies on the Structure Behaviors of Crosslinked PTFE Irradiated by Gamma Ray, Polymers & Polymer Composites, 2011,19(4-5).

^[2] Jinyou Lin, Feng Tian, Yanwei Shang, Fujun Wang, Bin Ding, Jianyong Yu, and Zhi Guo, "Co-axial electrospun polystyrene/polyurethane fibers for oil collection from water surface", Nanoscale, 2013,5.