Efficient Production of Filamentous Carbons Using the Liquid Pulse Injection Technique

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It is well known that all 3 types of filamentous carbons, carbon fibers, carbon nanofibers and carbon nanotubes, can be synthesized using the catalysis of nanoparticles of transision metals, such as iron. In order to elongate such carbons through this process quickly to produce them efficiently, the catalyst nanoparticles must have a proper size, which is a few to about 30 nm [1], and must also be in the molten state. Therefore, the key for efficient production of such carbons is how to generate such nanoparticles in a highly dense state in the reactor.

We found that the generation of nanoparticles in a highly dense state could be easily achieved by simply using liquid pulses of the starting material, instead of a continuous gas flow which is usually adopted in conventional production systems. By using the nanoparticles generated through this method, which we named the Liquid Pulse Injection (LPI) technique, for example, carbon fibers with lengths up to 50 mm can be obtained within 30 s (Fig. 1, Left) [2]. When the same method is used for the production of carbon nanofibers, products can be obtained at carbon yields up to 90% (Fig. 1, Right) [3].

In this presentation, the details of the LPI technique will be described. The unique features of the carbons obtained through this method will also be introduced.

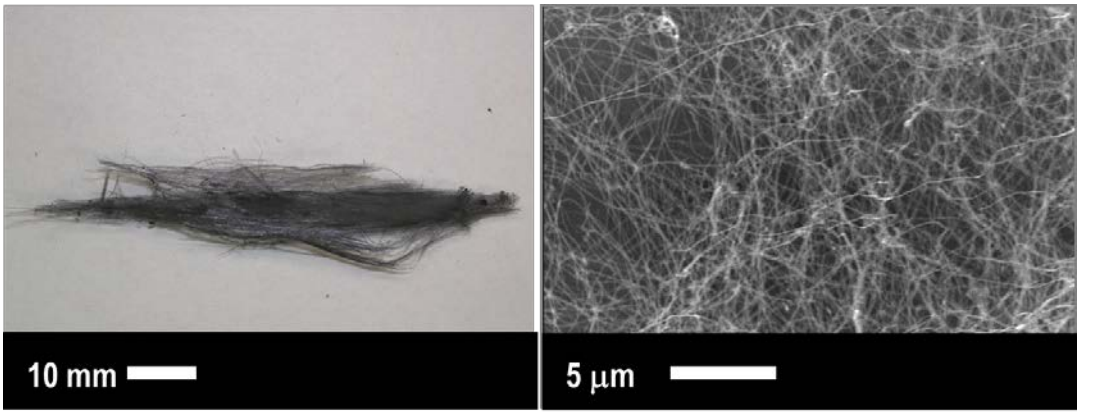

Figure 1: A photograph of carbon fibers (Left) and a SEM micrograph of carbon nanofibers (Right) obtained through the LPI technique

References:

[1] S. R. Mukai, T. Masuda, Y. Matsuzawa and K. Hashimoto, Chem. Eng. Sci. **53**, 439 (1998).

[2] Japanese Patent 3117523 (2000).

[3] Japanese Patent 6020850, U.S. Patent USP9475700, Chinese Patent ZL201380012268.0 (2016)

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