High-performance and aging-resistant HT-PEMFC electrode (HT-linked)

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Project Summary

Fuel cells are energy converters that convert chemical energy directly into electrical energy through electrochemical reactions on suitable catalysts. One particular type of fuel cell is the proton exchange membrane fuel cell (PEMFC). PEMFCs are limited by complex water management, low reaction kinetics, and sensitivity to gas contamination. This has led to an increasing interest in fuel cells that can operate at temperatures above 100 ° C. Phosphoric acid doped polybenzimidazole (PBI) membranes were prepared for fuel cell operation from 150 ° C to 200 °C without humidification. These high-temperature PEMFCs (**HT-PEMFC**) benefit from faster kinetics of the oxygen reduction reaction (**ORR**), simplified thermal management, and higher carbon monoxide tolerance. Despite these advantages, the lifetime of HT-PEMFC remains the primary concern. In HTPEM fuel cells, a more resilient membrane is essential in terms of chemical degradation, heat and mechanical stress in combination with increased proton conductivity. In operation, however, it comes to leacking and redistribution of proton-conducting phosphoric acid. In the **HT-linked** project, we try to address this problem by generating high-performance aging-resistant HT-PEMFC membrane electrode assemblies (MEA) through novel attachment concepts between catalyst, support and proton conductor. For synthesis, **co-axial electrospinning** is used to prepare porous carbon nanofibers (CNF) for use

in HT-PEMs. Two polymer solutions flow through a double nozzle to create a core-shell structure. Hollow and porous structures are obtained when a post-treatment such as washing or carbonizing is used. Targeted binding of the proton-conducting phosphoric acid into the **porous, hollow CNF** should take place by means of capillary forces.

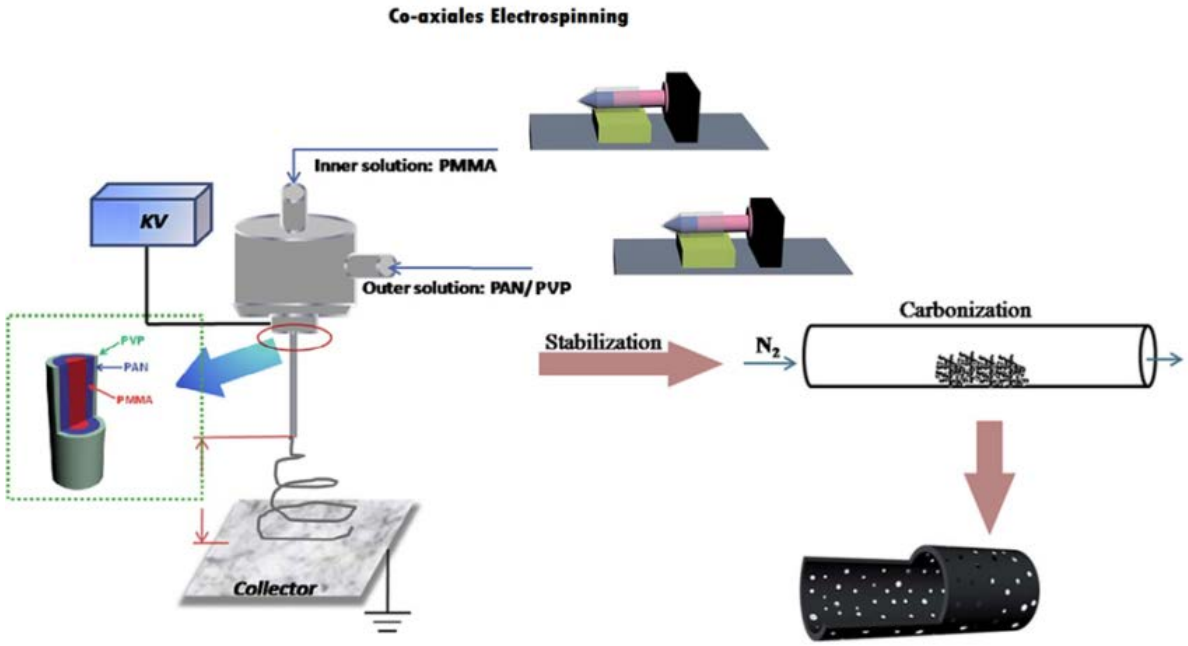

Figure 1: Illustration of the manufacturing process of HPCNF.