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Stationary Methanol Steam Reforming to Hydrogen Fuel for Fuel-Cell Filling Stations

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Abstract : Renewable hydrogen (H_2) carriers such as methanol (MeOH), dimethyl ether (DME), oxymethylene dimethyl ethers (OMEs), and conceivably ammonia (NH_3) can be reformed back into H_2 and are fundamental chemical conversions for the long-term viability of the H_2 economy due to their higher densities and ease of transportability compared to H_2. MeOH is an especially important carrier as it is a simple C1 chemical that can be produced from green solar-PV-generated H_2 and direct-air-captured CO_2 with a current commercially practical solar-to-fuel efficiency of 10% from renewable solar energy. MeOH steam reforming (MSR) in stationary systems next to H_2 fuel-cell filling stations can eliminate the need for onboard mobile reformers, and the former systems can be more robust in terms of attaining strict H_2 product specifications, and MeOH is a safe, lossless, and compact medium for long-term H_2 storage. Both thermal- and photo-catalysts are viable options for achieving the stable, long-term performance of stationary MSR systems.

Keywords : fuel-cell vehicle filling stations, methanol steam reforming, hydrogen transport and storage, stationary reformer, liquid hydrogen carriers
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