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Review on processing of metal–organic framework (MOF) materials towards system integration for hydrogen storage

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Summary

Development of safe and effective hydrogen storage systems is critical for further implementation of hydrogen in fuel cell technologies. Amongst the various approaches to improve the performance of such systems, porous materials-based adsorptive hydrogen storage is envisaged as a long-term solution because of the excellent reversibility, good kinetics and the possibility to store hydrogen at low pressures. Metal–organic frameworks (MOFs) have attracted much attention as porous hydrogen storage materials in the transition from the laboratory to commercial applications. However, MOF materials are often obtained as loose powders with low packing densities and low thermal conductivities. Therefore, to facilitate this transition and enable the MOF materials to form part of a practical hydrogen storage system, knowledge of the 'processing' techniques to improve the properties of the powders is essential. However, the processing routes of MOF materials towards system integration are rarely reviewed in the literature although this is of great significance in their proper assessment and potential use for hydrogen storage on a commercial scale. In this review, we begin by introducing the general requirements of an MOF materials-based hydrogen storage system and present how these requirements translate into desired characteristics for further processing. Then, an overview of MOF materials processing towards system integration is provided with an emphasis on improving selected properties including (i) structural stability, (ii) thermal conductivity and (iii) hydrogen storage properties.