Synthesis and characterisation of neodymiumbased MOFs for application in carbon dioxide reduction to syngas†

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Abstract

Two new neodymium-based metal–organic frameworks, JMS-10 and JMS-11, were synthesised using a 2,20-bipypridine-5,50-dicarboxylic acid (bpdc) linker. Both MOFs were solvothermally synthesised in DMF under different conditions. JMS-10 was synthesised at 120 1C while JMS-11 was synthesised at 100 1C in the presence of a modulator. Both the MOFs possessed very similar crystallographic parameters but were found to be structurally diverse. Their structures were built by secondary building units (SBUs) made up of carboxylates binding in sets of four and two to the straight rod, thus forming two types of alternating nodes that are 6- and 4-connected. Both JMS-10 and JMS-11 were functionalized using the ruthenium p-cymene complex. The functionalized MOFs were applied in the photocatalytic reduction of carbon dioxide to syngas where they produced both hydrogen and carbon monoxide (CO : H2) in the ratio of 1 : 2. The amount of CO to H2 produced varied depending on the additives used in the reaction medium, highlighting the importance of water, triethanolamine and acetonitrile in tuning the syngas ratio for different industrial applications.