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Vertically co-oriented two dimensional metal-organic frameworks for packaging enhanced supercapacitive performance

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Metal–organic frameworks (MOFs) are promising materials for batteries and supercapacitors. However, random crystal orientations and low conductivity can result in poor performance. Designing a convenient method to address these issues is therefore an important challenge. Here we describe an efficient strategy to fabricate self-supported MOF wall-like architectures with uniform orientation on carbon nanowalls (CNWs) as seedbeds. In addition, we gain molecular-level insight into the interface between CNWs and MOF nanosheets using density functional theory calculations. Our results suggest that assembled ions anchor on edge carbon atoms to match the matrix of the edges of CNWs, while the remaining ions self-assemble with terminal –COOH groups on *p*-benzenedicarboxylic acid ligands to form the structure. Our findings demonstrate a feasible method to fabricate integrated MOF electrodes with ideal orientations and, therefore, may pave the way to unlock the inherent high performance of MOF materials towards a number of engineering applications.

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