

## ABSTRACT

Metal organic frameworks (MOFs) are a unique type of hybrid porous materials in which metal ions or clusters are interconnected through polyfunctional organic ligands. Compared to conventional microporous and mesoporous inorganic materials, these metal-organic structures display advantages such as unprecedented internal surface areas (up to  $10000 \text{ m}^2\text{g}^{-1}$ ), tunable and extra large pore sizes, an intrinsically high metal content, structural diversity, crystalline open structures and the ease of processability, flexibility and geometrical control. These outstanding properties render MOFs nascent candidates for being used as heterogeneous catalysts, catalyst supports and adsorbents. Hybrid catalysts currently offer an appropriate route for boosting the catalytic performance. More than thousands of MOFs of various compositions have been reported to date. The number of studies on MOFs and MOF composite materials has risen year after year over the last decade. The main objective of this thesis was to fabricate a series of CaO-immobilized metal-organic-framework (MOF) nanoparticles, using an in-situ growth and scalable approach, combining excellent thermal and chemical stability, and recyclability. Using different characterization techniques, comprising FTIR, XRD, UV-Vis, TGA,  $^1\text{H}$  NMR,  $\text{N}_2$ -isotherms, FESEM-EDS, and TEM, the fabricated catalyst was investigated. The CaO-immobilized MOF nanoparticles comprising of stable  $\text{NH}_2$ -MIL-101 (Cr) provide both Lewis acidic and basic sites and CaO offers Lewis basic sites. Hence, the MOF composite showed outstanding catalytic properties for Knoevenagel condensation reaction with facile reusability. The CaO/ $\text{NH}_2$ -MIL-101 (Cr) catalyst used in Knoevenagel reaction is applicable to benzaldehyde derivatives comprising both withdrawing and donating electron moieties with exceptional conversions.