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In the past fifteen years a large number of metal organic coordination networks (MOCNs) has been designed and developed for their diverse structural aesthetics and for a variety of potential applications in catalysis, separation, sensors, gas storage, luminescent materials, ion exchange, magnetism, etc. Formation of infinite one-, two-, and three dimensional (1D, 2D, and 3D) MOCNs requires highly organized structures held together through various interactions, such as metal-donor atom coordinate bonds, strong and/or weak hydrogen bonds, pi-pi stacking of aromatic moieties, C-H…O interactions, etc. This thesis focuses on the strategic design and development of MOCNs through reproducible synthesis under ambient as well as hydrothermal conditions. Over one hundred new MOCNs comprised of divalent transition metal ions, polydentate ancillary ligands and multiatom carboxylate linkers have been synthesized in good to high yields. For making these MOCNs several ancillary ligands (with improved yields and purity) have also been synthesized and characterized. Through systematic studies, such MOCNs with well-defined structures and tunable metrics are obtained. These have diverse structures and topologies, are chemically and thermally stable, have a variety of functions. These are characterized by elemental analysis, FT-IR, Raman and UV-Vis spectroscopy, single crystal and powder X-ray diffraction, and ESI-MS analysis as well as are studied for their redox behavior by cyclic voltammetry, morphology by scanning electron microscopy and thermal properties by thermogravimetric analysis and differential scanning calorimetry. Their photoluminescent properties are established by fluorescence spectroscopy in the solid state. Several of these MOCNs are found to be porous (termed as Metal Organic Frameworks) and have been tested for their water and gas adsorption/desorption abilities.