Plug-and-Play Heterogeneous Catalysis Enabled by Metal-Organic Cage-Crosslinked Polymers

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1. Previous methods to immobilize homogeneous catalysts
   A. Amorphous polymers/gels
      - Swollen gels allow reagent mobility, facilitating catalysis
      - Amorphous nature makes it challenging to control local catalyst environment

   B. Metal-organic frameworks (MOFs)
      - Exquisite tuning of catalyst environment
      - Materials are often glassy and brittle
      - Reagent flux issues can reduce catalytic activity

2. Polymer metal-organic cages (PolyMOCs) can be easily functionalized without changing the mechanical properties
   - PolyMOCs feature large metal-organic cages (MOCs) which serve as cross-link junctions between polymer chains
   - Elastically inactive strands and redundant connections can be replaced with small molecule templating ligands with little effect on mechanical properties

3. Acetylene ligands give enough space for catalyst functionalization of PolyMOCs
   A catalyst can be appended to the unfunctionalized ligand (UL) para- to the OMe, placing it inside the MOC without affecting the polymer network

4. TEMPO catalyst functionalizes the polyMOC to make PolyCAT
   A. Synthesis
   B. Materials properties unchanged
   C. EPR shows incorporation of TEMPO
   D. Cyclable oxidation catalysis

5. PolyCAT can also contain metal catalysts such as Au(I)
   A. Synthesis
   B. Materials properties unchanged
   C. Cyclization catalysis can occur in solubilizing and non-solubilizing solvents

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