NOVELTY OF THE WORK

1. Designing of new materials at molecular level, (a) Lacunary polyoxometalates, LPOMs and (b) Transition Metal Substituted Polyoxometalates, TMSPOMs was successfully achieved.

2. Development of third generation sustainable and novel heterogeneous catalysts by supporting PMo_{11} onto ZrO_2 and Al_2O_3 as well as their use for oxidation reactions was successfully achieved.

3. The designed heterogeneous catalysts were found to be promising sustainable alternative for the environmentally hazardous stoichiometric catalysts and were effective in waste minimization, especially for oxidation reactions.

4. The superiority of the present work lies in obtaining high selectivity of carbonyl products with excellent turn over number.

5. For the first time easy one pot synthesis of cesium salt of Co, Mn and Ni-substituted phosphomolybdates ($PMo_{11}M$; M= Co, Mn, Ni) was introduced.

6. The designed $PMo_{11}M$ were efficiently used as heterogeneous catalysts with O_2 as well as homogeneous catalysts with H_2O_2 for solvent free liquid phase oxidation reactions.

7. For the first time, a reaction mechanism for aerobic oxidation of alkenes and alcohols involving TBHP as an initiator over $PMo_{11}M$ was proposed.

8. For the first time $PMo_{11}Ni$ was used as an sustainable catalyst for Suzuki-Miyaura coupling.

Papers Presented at Conference/ Symposia:

1) "Clean and green oxidation of styrene over supported undecamolybdophosphate using environmentally benign oxidant", by **S. Pathan,** A. Patel at National Conference on Challenges to Chemical Sciences in Twenty First Century, at Department of Chemistry, Hemchandracharya North Gujarat University, Patan, 1st – 2nd Feb (2011)

2) "Synthesis and structural characterization of mono Mn(II)-substituted phosphomolybdate and its use as catalysts for solvent free selective oxidation of alkenes", **S. Pathan,** A. Patel, MTIC, University of Hyderabad, Dec (2011)

3) "Selective oxidation of alkenes over supported undecamolybdophosphate using hydrogen peroxide: Green and Sustainable Approach" **S. Pathan,** A. Patel, Catalysis For Sustainable Development, Department of Chemistry, Faculty of Science, The M. S. University of Baroda, Vadodara, Jan (2012)

4) "Green oxidation process for selective synthesis of benzaldehyde using cesium salt of undecamolybdophosphate" **S. Pathan,** A. Patel, S. Singh, International Workshop on Chemistry for a Sustainable Future, Jaipur, 10-12th Dec (2012)

5) "Suzuki-Miyaura Cross-Coupling reaction in Aqueous Media catalyzed by Keggin type mono Pd(II)- substituted phosphomolybdate" **S. Pathan,** A. Patel, International conference on Emerging Trends in Chemical Sciences, School of Chemistry Science, Central University of Gujarat, Gandhinagar, 14-15th March (2013)