

Zeolite as Solid Acid Catalyst for Organic Transformations

Dr. M. K. Lande

Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra, India

ABSTRACT

Last few years chemists are developing new approaches for synthesis of materials for human needs, such as food, medicines and consumer products and also plays crucial role in building up strong economy, environmental awareness. This can be achieved by increasing product selectivity, 100% atom economy, reaction time economy and replacing stoichiometric reagents with heterogeneous and reusable catalysts such as zeolites, metal oxides, mixed metal oxides, heteropoly acids, nano-composite materials and biocatalyst.

Zeolites are complex hydrated crystalline inorganic polymers based on an infinitely extending three dimensional network of $[\text{AlO}_4]^{5-}$ and $[\text{SiO}_4]^{4-}$ units, these are linked via Si-O-Al bridges to form porous material. The framework structure contains pores, cavities and channels that are occupied by exchangeable cations from either alkali or alkaline earth metal ions or water molecules. This material shows good thermal and chemical stability, nontoxic in nature, also possesses Lewis and Bronsted acidic sites. Therefore, It has been used in the field of petrochemical & fine chemical industries, detergents, purification of water, purification solvents, and separation of gases, drug delivery and catalyst supports. Catalytic potential of these materials depends on the structural morphology, compositions, particle size, acidity, surface area, pore size, nature of active sites in the composite matrix. Tuning of these properties could be depends on synthetic methodologies and other physical and compositional parameters.

Recent advances of characterization techniques and their applications help us to understand, Why zeolite material acts as catalyst? Where is the location of active sites in materials? What are the acid strength of catalytic materials? However, In view of green chemistry approach, zeolites and modified zeolites are an excellent alternative source over conventional acid catalysts, as they can be inexpensive, nontoxic, non-corrosive simple to recover and reuse. Considering this views, I have planned to discuss the fundamental aspects of natural & synthetic zeolites, methods of modification, characterizations and utilization as solid acid in some organic chemical reactions.