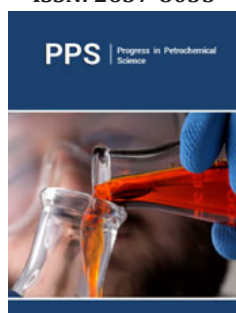


# A Brief Review on: Various Methods of Metal Catalyzed Olefin-Metathesis Reactions

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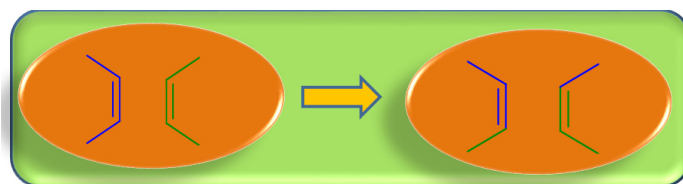
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## Abstract

In this short review, a brief description about olefin metathesis (OM) by transition metal complexes is presented. Metathesis reactions in olefin (organic eye compounds) are mostly carried out using transition organic-metal complexes (OMC) such as ruthenium, rhenium, molybdenum and tungsten based, schorrock, grubb's, Hoveyda-grubb's catalyst etc. These catalysts cause redistribution of  $\pi$ -bond of alkene by cross scission and rearrangement in compounds by the formation of cyclic (2+2cycloaddition) intermediate. OM reactions are efficiently used for the synthesis of neohexene by dimers of isobutene, conversion of detergent by shell higher olefin process and synthesis of many drugs.

## Graphical abstract



**Keywords:** Metathesis; Olefin; Metal catalyst; Cross-coupling reaction

**Abbreviations:** OMC: Organic-Metal Complexes; CM: Cross Metathesis; ROM: Ring-Opening Metathesis; RCM: Ring-Closing Metathesis; ROMP: Ring-Opening Metathesis Polymerization; ADMET: A Cyclic Diene Metathesis

## Introduction

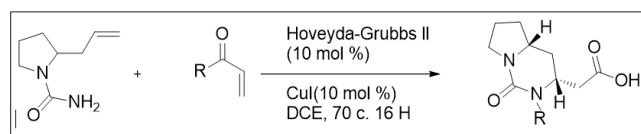
Metathesis of olefins is developed as catalytic synthesis method which is applied for synthesis in organic compounds like basic and fine laboratory chemicals, active pharmaceutical ingredients and it may also use as polymeric, noble materials. Olefin metathesis reactions are following particular mechanism just like ring-opening metathesis reaction, ring closing metathesis reaction, and acyclic diene metathesis reaction, cross metathesis reactions are following the formation of met allocyclic intermediate [1-9]. By the development in the structure of transition metal complexes, they get catalyze enzyme metathesis reactions with high turnover, and emerged a high interesting research area to produce various substitution in olefins. Organometallic catalysts are very efficient for these reactions like ruthenium hydrides [10-14], Grubbs-I catalyst [15], palladium [16], Hoveyda-Grubbs pre-catalyst on zirconia membrane [17]. Fogg et al. [18] have reported that olefin metathesis is used as a technology for Industrial production of derivative of olefin.

## Types of Olefin Metathesis

### Cross metathesis (CM)

For the cross synthesis of cyclic and bicyclic compounds via Pd-catalyzed alkene [19,20] with N-alkylureas and alkenyl halides, they give the mixture of products of acyclic or cyclic compounds [21-22]. Such types of reactions show the cross-metathesis reaction, in the method of preparations of cyclic or acyclic compound via cross metathesis, use simpler methods as synthesis of cyclic urea's using  $\alpha$ ,  $\beta$ -unsaturated carbonyl compounds with pentad dentate ligand in metal complexes followed by cross-metathesis reaction. In these reactions,

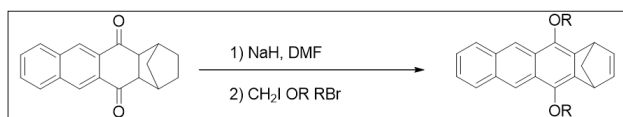
formation of C-N and C-C bond formation takes place [23]; (Figure 1).



**Figure 1:**

### Ring-opening metathesis (ROM)

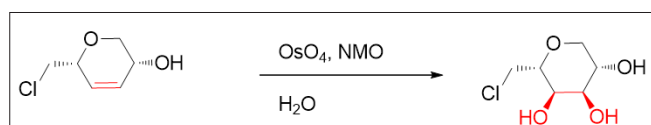
For the synthesis of long chain polymers ring-opening metathesis polymerization (ROMP) method is used which is firstly introduced by Hillmyer et al. [24-26] via using 4-cis-butenediols using ruthenium carbene organometallic complexes. Heterodentates-chain polymers are carrying two different functional groups at the end of chain (Figure 2). Such types of polymerization methods are, mostly applicable for the synthesis of flexible biologically active molecules [27,28].



**Figure 2:**

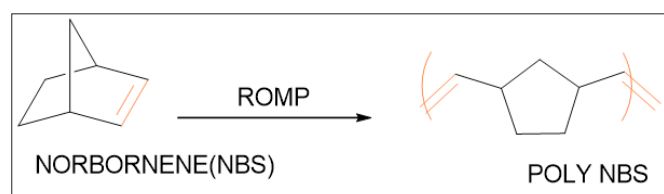
### Ring-closing metathesis (RCM)

In the synthesis of ring closing reactions stereo-specific skeleton structure is found in bio-active compounds, it's very unique synthetic procedure in the field of polymer chemistry, via development into synthetic method (Figure 3), which is limiting the potential for biomedical applications. Here we have discussed about the synthesis of a stereo-selective compound by 1,4-linkage in six-membered cycle polyether which is prepared by the method of ring-closing metathesis (RCM) [29].



**Figure 3:**

### Ring-opening metathesis polymerization (ROMP)



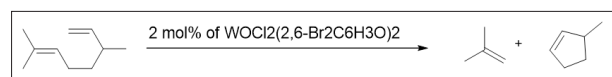
**Figure 4:**

Ring-opening metathesis polymerization (ROMP) is an efficient method for the formation of practically important in various fields of applied science, as functionalization in polymeric materials to form advance material structures [30-32]. ROMP of norbornadiene (NBD) in the presence of  $[\text{RuCl}_2(\text{PPh}_3)_2(\text{pyrrolidine})]$  as the starting

complex and catalyst and the reaction at room temperature with 2mL of  $\text{CHCl}_3$ , for 30 minutes. Measured yields of poly-NBD were found in inert argon atmosphere [33]; (Figure 4).

### A cyclic diene metathesis (ADMET)

Acyclic diene metathesis (ADMET) is a method of synthesis of cyclic and acyclic end compound via fragmentation of  $\alpha, \omega$ -diene monomer. These types of polymers can be self-interconvertible or by the use of catalyst, which causes the pi-pi interaction between conjugated diene, and the movement of electron is enhanced [34]. These reactions are carried out in presence of 2mol% of  $\text{WOCl}_2$  ( $2,6\text{-Br}_2\text{C}_6\text{H}_3\text{O}_2$ ) as catalyst,  $\alpha, \omega$ -diene monomer for 1 hour into the corresponding in 68-70% isolated yield [35]; (Figure 5).



**Figure 5:**

### Conclusion

Here we are describing some new methods for synthesis of alkenes by metathesis. These new methods are having versatile application in the field of industry, biomedical and other porous material synthesis. Ring-opening metathesis polymerization process give an opportunity, with which we can develop nanoporous polymers with the structure having high surface area. Ring-closing metathesis is very ease for the synthesis of co-polymerized material and the ring size can be modulated or multi-functionalized by use of different solvent cause di-hydroxylation for example olefin group converted into sugar like structure as polyethylene glycol. Modification in bioactive molecule like amylase, via change in configuration of STERI GENIC center in cyclo-polymers. New cross-metathesis reactions are used as a transformation effect for the synthesis of derivatives of olefin with diene and allyl group for the formation of bi-cyclic and mono-cyclic ends. Metathesis reactions are highly emerging area in the field of pure organic synthesis. It can be further improved for the symmetric and asymmetric synthesis of olefins.

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