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**EDUCATIONAL DETAILS**

- 2016 : **Post doctorate** in Physical chemistry from **North west University, Potchefstroom**, South Africa (Aug 2015 to July 2016)
- 2015 : **Ph.D. in Physical Chemistry** from **Charles University, Prague**, Czech Republic, Europe. (June 2010 to March 2015)
- 2008 : **M. Tech in Industrial Catalysis** from **Cochin University Of Science and Technology, Kerla** (Aug 2006 to Sep 2008)
- 2002 : **M.Sc. in Polymer Chemistry** from **North Maharashtra University, Jalgaon**.
- 2000 : **B.Sc. in Chemistry** from **North Maharashtra University, Jalgaon**.

**PROFESSIONAL EXPERIENCE**

- ❖ **Assistant Professor and First year Co-ordinator**, at **Shri Vile Parle Kelavani Mandal's Institute of Technology, Dhule** from 28/08/2017 to till date.
- ❖ **Postdoctoral Fellow**, at **North West University, Potchefstroom** South Africa from 01/08/2015 to 31/07/2016.
- ❖ **Ph.D students** in **J Heyrovsky Institute of Physical Chemistry, Prague, Europe** from 02/06/2010 to 04/03/2015
- ❖ **Project Students** at **National Chemical Laboratory, Pune**, India from 01/07/2007 to 03/03/2008

❖ **INDUSTRIAL /RESEARCH WORK LOCATION:**

**1. J. Heyrovsky Institute of Physical Chemistry, Prague, Czech Republic, Europe.**

02/06/2010 to 04/03/2015

**NATURE OF WORK:**

Homogeneous and heterogeneous catalysis, olefin metathesis, ring opening metathesis polymerization, organometallic catalysts anchored on mesoporous molecular sieves, ring opening metathesis polymerization of vinyl norbornene.



❖ **RESEARCH PROJECT:**

**"Ruthenium alkylidenes immobilized on mesoporous molecular sieves as catalysts for olefin metathesis".**

**Team: -**

**Description: -**

The main emphasis of the dissertation focuses on the preparation of new heterogeneous metathesis catalysts, their characterization, and testing their activity and selectivity in different metathesis reactions. This work has been completed at the Department of Synthesis and Catalysis, J. Heyrovský Institute of Physical Chemistry, AS CR.

Hoveyda-Grubbs type catalyst **ZC** (Zhan catalyst 1-B) was immobilized on mesoporous molecular sieves of different architecture and pore diameter,  $d$ , (hexagonal: MCM-41,  $d = 4.0$  nm; SBA-15,  $d = 6.8$  nm; SBA-15 large pore (LP),  $d = 11.1$  nm and cubic: MCM-48,  $d = 6.0$  nm) and conventional silica (Merck) for comparison. The immobilization was done by simple mixing of **ZC** solution with appropriate support at room temperature. Ru loading in all immobilized catalyst was 0.93 wt%. The catalysts and supports were characterized by X-ray diffraction and nitrogen adsorption measurement. It was found that regular architecture and mesoporous character of supports were preserved during immobilization. Catalyst characterization was also done using X-ray photoelectron spectroscopy (XPS) and UV-Visible spectroscopy (UV-Vis). XPS and UV-Vis spectroscopic studies of **ZC** immobilized on SBA-15 (**ZC/SBA-15**) indicated the attachment of **ZC** on mesoporous sieve surface by non-covalent interactions because i) UV-Vis suggested no changes in the coordination sphere after immobilization and ii) XPS spectra showed the same binding energy of Ru '3d' electrons ( $281.2 \pm 0.2$  eV) and molar ratio Cl/Ru = 2.0 before and after immobilization. NMR spectroscopy showed that approximately 76% of Ru content was recovered from **ZC/SBA-15** as original **ZC** by washing **ZC/SBA-15** with tetrahydrofuran at room temperature.

The immobilized catalysts exhibited high activity and 100% selectivity in ring-closing metathesis of diethyl diallylmalonate and 1,7-octadiene, in metathesis of methyl oleate and methyl 10-undecenoate, and in the ring-opening metathesis polymerization of cyclooctene. Ru leaching was dependent on the solvent and substrate used for the reaction. In non-polar system Ru leaching was negligible (0.04% of starting Ru amount for ring-closing metathesis of 1,7-octadiene in cyclohexane), however, the highest Ru leaching was observed in polar system (14% for ring-closing metathesis of diethyl diallylmalonate in dichloromethane). The filtration experiment carried out for ring-closing metathesis of 1,7-octadiene and citronellene proved that the catalytic active species were completely bound to the solid phase in non-polar solvent.

A positive effect of the pore size of the supports on catalyst activity was observed for ring-closing metathesis of  $-(\beta)$ -citronellene, metathesis of 1-decene, acyclic metathesis polymerization of 1,9-decadiene, and ring-opening metathesis polymerization (ROMP) of cyclooctene. In all cases, the initial reaction rate increased with increasing pore size of the catalyst support; however, support architecture did not play any



important role. Mesoporous molecular sieves based catalysts were more active as compared to conventional silica based catalyst. In ROMP of cyclooctene, mesoporous molecular sieves based catalysts produced high molecular weight polymers ( $M_w$  about 300,000) in high yields (70–80%). However, in case of conventional silica based catalyst the polymerization stopped after 15 min of the reaction and only 40% yield of polycyclooctene was obtained. These results indicate the advantages of mesoporous molecular sieves based catalyst for ROMP. The effect of catalyst, substrate concentrations and temperature on the reaction rate was studied in ring-closing metathesis of citronellene and high TON (4010) was achieved using a very small amount of catalyst ( $C_{Ru}^0 = 0.042$  mmol/L). **ZC** catalyst was able to catalyze enyne cross-metathesis of aliphatic alkenes and alkynes but heterogeneous catalyst failed in this case.

The activity of a new heterogeneous catalyst, Grubbs second generation catalyst immobilized on SBA-15 via phosphine linker (**G.II/SBA-15**), and **ZC/SBA-15** was tested in metathesis and cross-metathesis of cardanol (the main component of Cashew Nut Shell Liquid). Both heterogeneous catalysts proved to be highly active and selective in cardanol metathesis and cross-metathesis with ethene and cis-1,4-diacetoxy-2-butene (DAB) (in cardanol metathesis, TON = 1125 and 2075 for **G.II/SBA-15** and **ZC/SBA-15**, respectively). In cardanol ethenolysis, 3-(non-8-enyl)phenol was isolated as a major product. In cross-metathesis of cardanol with DAB, 9-(3-hydroxyphenyl)non-2-enyl acetate and non-2-enyl acetate were formed with high selectivity. 3-(non-8-enyl)phenol and non-2-enyl acetate found applications as detergent precursors and flavor and fragrance agents. Easy separation of both catalysts from products and low Ru leaching (0.5% for **G.II/SBA-15** and 2.5% for **ZC/SBA-15**) ensure the delivery of products of low contents of Ru residues.

## 2. National Chemical Laboratory, Pune

01/07/2007 to 03/03/2008

### **NATURE OF WORK:**

- Biomass Conversion, Heterogeneous catalysis, Mesoporous molecular sieves

### ❖ **RESEARCH PROJECT:**

**“Heterogeneous catalytic transformation of glucose / fructose into 5-hydroxymethyl furfural”.**

**Team:** - Two

**Description:** -

This Project was on biomass conversion into value-added chemicals, which I did in National Chemical Laboratory, Pune, India. I worked on preparation of some solid acid catalyst like, MCM-41, Al- MCM-41, Ga-MCM-41, Sn- MCM-41 and preparation of some supported metal catalyst. The characterization of the catalysts were done by using different techniques like, SEM, TEM, BET and XRD. Moreover, I have performed liquid phase reactions that lead to the transformation of biomass into chemicals.



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In this work, it has been demonstrated that a single phase and biphasic system can be applied to process diverse feedstock molecules to produce HMF. After screening large number of catalyst under various reactions conditions it can be concluded that solid catalyst with low acidity, as shown by Ti-silicate (Both amorphous and crystalline with Si/Ti = 30 or less) and MCM-41 type materials like Al-MCM-41 (Si/Al =100) are best suited catalyst for Glucose / fructose conversion to 5-HMF. The large number of side product are formed in this reaction. The product was isolated and yield was calculated.

## **Barriers:**

Difficult and tedious analysis and isolation methods very reactive and unstable nature of 5-HMF giving secondary product.

## **3. TATA Chemicals Innovation Research Centre, Pune**

03/03/2008 to 13/08/2009

### **NATURE OF WORK:**

- Biodiesel, Biolubricant, Heterogeneous catalysis.

### **RESEARCH PROJECT:**

**“Synthesis of biodiesel and biolubricant using solid catalyst”**

**Team: - four**

### **Description: -**

Normally in case of Biodiesel, people use NaOH as homogeneous catalysts, which has some problem of catalyst –Product separation, and reusing but it could be overcome by using heterogeneous catalysts. Hence, in above project I have tried to use heterogeneous catalyst in the production of biodiesel and bio lubricant.

## **1. Patent**

<b>Sr. No.</b>	<b>Details of Publication</b>	<b>Application Number</b>	<b>Inventors</b>
1	A process for production of biodiesel.	PCT/IN2009/000331 (WO 2010/082211)	Dr. Tushar Shinde, Dr. Rajiv Kumar, Dr. Nawal kishor Mal, Dr. K S Nagabhushna
2	A process for production of biodiesel.	PCT/IN2009/000295 (WO 2010/082210)	Dr. Tushar Shinde, Dr. Rajiv Kumar, Dr. Nawal kishor Mal, Dr. K S Nagabhushna



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3	A process for production of biolubricant using fly ash as a catalyst.	PCT/IN2009/000586 (WO 2011/007361)	Dr. Tushar Shinde, Dr. Rajiv Kumar, Dr. Nawal kishor Mal, Dr. K S Nagabhushna
4	Catalysed production of fatty acid alkyl esters from fatty acid glycerol esters and alkanols.	PCT/IN2009/000587 (WO 2011/007362)	Dr. Tushar Shinde, Dr. Rajiv Kumar, Dr. Nawal kishor Mal, Dr. K S Nagabhushna

## 2. Research Papers Presented / Published:

Sr. No.	Details of Publication	National/International	Publisher, Vol, Indexing, impact factor	Author (s) / Editor (s)
1	Ring opening metathesis Polymerization of vinyl norbornene and following polymer modifications.	International	J. Polym. Res, 21 (2014) 557. <b>I.F. = 1.530</b>	Hynek Balcar, <u>Tushar Shinde</u> , Martin Lamač, Jan Sedláček
2	Metathesis of cardanol over Ru catalysts supported on mesoporous molecular sieve SBA-15.	International	Applied Catalysis A: General, 478 (2014) 138. <b>I.F. = 4.630</b>	<u>Tushar Shinde</u> , Vojtěch Varga, Miroslav Polášek, Michal Horáček, Naděžda Žilková and Hynek Balcar
3.	Hoveyda Grubbs types Metathesis catalyst immobilized on mesoporous molecular sieves – The influence of pore size on the catalyst activity	International	Catalysis Today, 179 (2012) 123. <b>I.F. = 4.888</b>	<u>Tushar Shinde</u> , Naděžda Žilková, Vladimíra Hanková, Hynek Balcar



4.	. Hoveyda Grubbs type metathesis catalyst immobilized on mesoporous molecular sieves MCM-41 and SBA-15.	International	Beilstein J. Org. Chem., 7 (2011) 22.  I.F. = 2.595	Hynek Balcar, <u>Tushar Shinde</u> , Naděžda Žilková, Zdeněk Bastl
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### 3. Workshop / Conferences / Seminars Attended

Sr. No.	Title of Paper	Name of Conference in which published	Date of Publication
1	Hoveyda –Grubbs metathesis catalyst immobilized on mesoporous molecular sieves MCM-41 and SBA-15. (Poster)	, 42 <sup>nd</sup> symposium on catalysis, Prague, CZ, Europe	1 to 2 November 2010
2	Ring opening metathesis polymerization of vinylnorbornene and following polymer modifications. (Poster)	Czech Italian Spanish conference, Prague, CZ, Europe	15 to 18 June, 2011
3	Hoveyda-Grubbs type metathesis catalyst immobilized on mesoporous molecular sieves: The influence of pore size on catalyst activity. (Poster)	ISOM 2011, University Rennes, France	10 <sup>th</sup> to 15 July, 2011
4	Activity of non-covalently immobilized Hoveyda Grubbs type metathesis catalyst on mesoporous sieves. (Poster)	43 <sup>rd</sup> symposium on catalysis, Prague, CZ, Europe	7 to 8 November 2011
5.	Hoveyda-Grubbs second-generation type metathesis catalyst immobilized on different mesoporous molecular sieves: The influence of pore size on catalyst activity. (Poster)	Symposium on Homogeneous Catalysis, Toulouse, France	9 <sup>th</sup> to 13 July 2012.
6	Ring opening metathesis polymerization of vinylnorbornene using molybdenum and ruthenium catalysts. (Oral)	, 44 <sup>th</sup> symposium on catalysis from, Prague, CZ, Europe	5 to 6 November 2012
7	Immobilization of ruthenium catalyst on SBA-15: Comparative study for the metathesis of cardanol. (Poster)	Balcar 45 <sup>th</sup> symposium on catalysis, Prague, CZ, Europe	4 to 6 November 2013



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<b>8</b>	SBA-15 immobilized ruthenium alkylidene for metathesis of cardanol. (Oral)	School of molecular sieves 2014, Prague, CZ, Europe	March 17 to 18, 2014
<b>9</b>	Immobilization of ruthenium catalysts on inorganic support and testing thereof in cardanol metathesis. (Oral)	Uka Tarsadia University, Bardoli, Gujrat	February 22 - 23, 2019
<b>10</b>	Laboratory and Industrial Safety and Hazards (LISH - 2019) - Workshop	School of Chemical Sciences, KBC NMU, Jalgaon	March 13, 2019
<b>11</b>	<b>List of FDP Program Attended</b>		
	<ol style="list-style-type: none"> <li>1. Completed five days FDP on, <b>"Outcome Based Education and NBA Accreditation Process"</b> organized Internal Quality Assurance Cell (IQAC) during <b>8 June 2020 to 12 June 2020</b> held at P. R. Pote College of Engineering And Management" Amaravati.</li> <li>2. Completed five days FDP on, <b>Engineering Education &amp; the Industry: A Post Covid 19 Perspective"</b> held during <b>1<sup>st</sup> June 2020 to 5<sup>th</sup> June 2020</b> at Rajiv Gandhi Institute of Technology, Mumbai.</li> <li>3. Completed FDP on, <b>"ART of Research Paper Writing and IPR"</b> organized by Pimpri Chinchwad College of Engineering, Pune between <b>25<sup>th</sup> to 27 May, 2020</b>.</li> <li>4. Completed FDP program on, <b>"Meditation and Breath"</b> from <b>18<sup>th</sup> May to 21<sup>st</sup> May</b> organized by Dr. Babasaheb Ambedkar Technological University, Lonere, India.</li> <li>5. Completed FDP on, <b>"Renewable Energy Sources: A Way Ahead"</b> organized by cumins college of Engineering for women during <b>15<sup>th</sup> May to 21<sup>st</sup> May 2020</b>.</li> <li>6. Completed FDP on, <b>"NAAC Awareness program for faculty"</b> organized by Marathwada Mitra Mandal Institute of Technology conducted during <b>8 May 2020 to 14 May 2020</b>.</li> <li>7. Completed one week FDP on, <b>"Overcoming the Challenges in Adapting Online Technology in Teaching Learning"</b> held during <b>6<sup>th</sup> to 11<sup>th</sup> May, 2020</b> at Jhulelal Institute of Technology, Nagpur.</li> <li>8. Completed FDP on, <b>"How to Create Digital Bonding on Teachers"</b> organized by Tilak College of Science and Commerce College, Vashi And North Storm Academy held on <b>3<sup>rd</sup> May 2020</b>.</li> </ol>		
	<b>List of Workshop Attended</b>		
	<ol style="list-style-type: none"> <li>1 Completed one day workshop on, <b>"LINUX"</b> organized by Teaching Learning Centre, ICT at IIT Bombay on <b>23<sup>rd</sup> August, 2019</b>.</li> <li>2 Completed three days on, <b>"Online Teaching Learning workshop for the faculties"</b> conducted by QASPIR on <b>April 1 to April 3, 2020</b>.</li> <li>3 Completed five days' workshop on, <b>"Mental Health Awareness during COVID-19 by DBATU &amp; JDCOEM Nagpur on 6<sup>th</sup> May 2020 to 10<sup>th</sup> May 2020</b>.</li> </ol>		



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4. Completed three days' workshop on, "NAAC Awareness and Accreditation: A step by step process" held during 28<sup>th</sup> May to 30<sup>th</sup> May 2020 at GATES IOT, AP.
5. Completed three days' workshop on, "Effective Use of IT and Security Services during Covid-19" conducted by D J Sanghvi College of engineering, Mumbai on 2<sup>nd</sup> June 2020 to 4<sup>th</sup> June 2020.
6. Four days' workshop on, "Effective Use of MS Office 365 Applications" conducted by D J Sanghvi College of engineering, Mumbai on 9<sup>th</sup> June 2020 to 12<sup>th</sup> June 2020.
7. Webinar given on, "Online guidance and interactive session over CET Mock Test" for 12<sup>th</sup> standard students on 23 May 2020.

### List of NPTEL - FDP Courses Completed

1. Secured **98% score** in NPTEL course on "Transition metal Organometallics in Catalysis and Biology" conducted by IIT Bombay for **12 Week Course** (Jan-Apr 2020).

Sr. No.	Name of Institution / Society	Grade of membership	Date of Election	Whether still a member
01	<ul style="list-style-type: none"> <li>▪ Editorial board member of Science Publishing Group, NEWYORK, U.S.A., in American Journal of Applied Chemistry (AJAC) – ISSN: <b>2330-8753</b></li> </ul>	Member	22 June 2020	Yes
02	Senior Membership in Hong Kong Chemical, Biological & Environmental Engineering Society (HKCBEEES) a registered international society of Hong Kong, USA & China. <b>Member Number: 101768.</b>	Member	09 June 2020	Yes

#### 4. Special Achievements:

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|--|-----------|
| ☑ North West University Potchefstroom, South Africa                              | 2015-2016 |
| ☑ Charles University Scholarship, Prague, CZ                                     | 2010-2014 |
| ☑ Research award for Biodiesel in TATA Chemicals Innovation Center, Pune, India. | 2009      |
| ☑ National level UGC-PG GATE Scholarship, India                                  | 2006-2008 |





**5. AREA OF INTEREST**

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Olefin Metathesis, Mesoporous Molecular Sieves, Heterogeneous catalysis, Homogeneous catalysis, Biodiesel, Biolubricant, Biomass Conversion, Adsorption and catalysis.