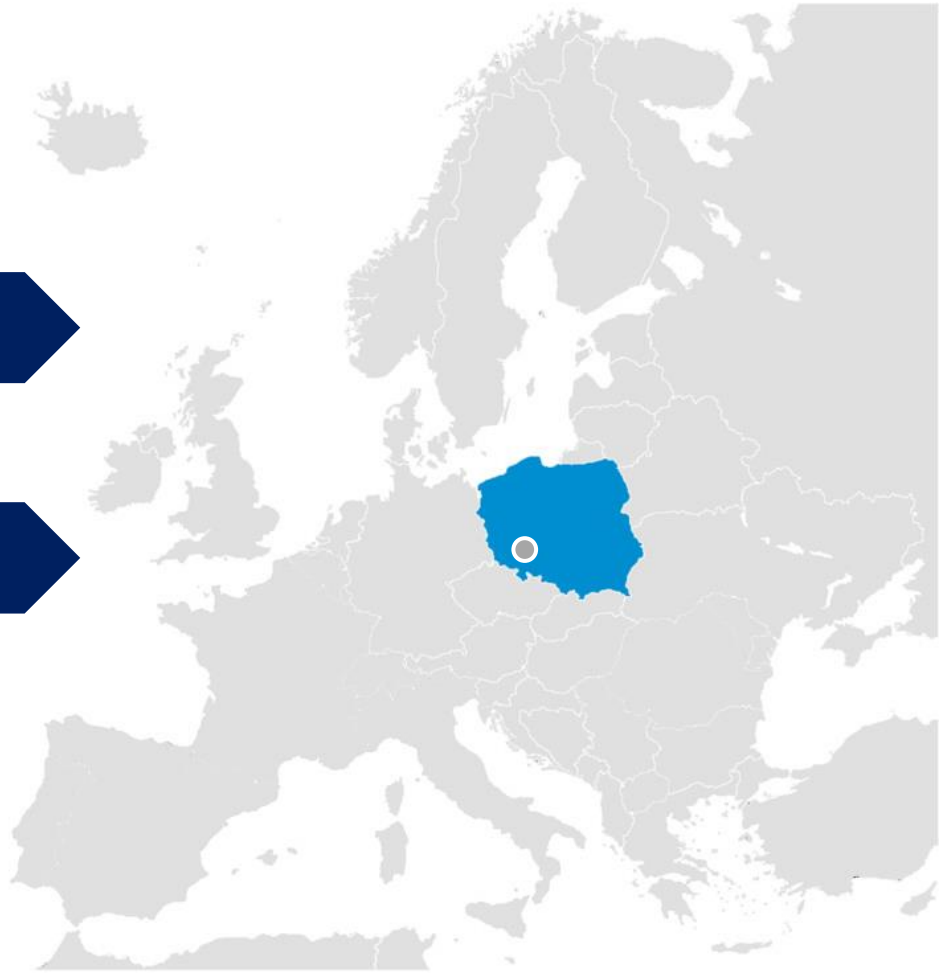

Apeiron
synthesis
Leading the way in metathesis
booth #906
Process Oriented Olefin
Metathesis Catalysts
for Industrial Applications

Apeiron Synthesis S.A. - Location

WROCŁAW – OLD CITY

WROCŁAW TECHNOLOGY PARK



What we provide

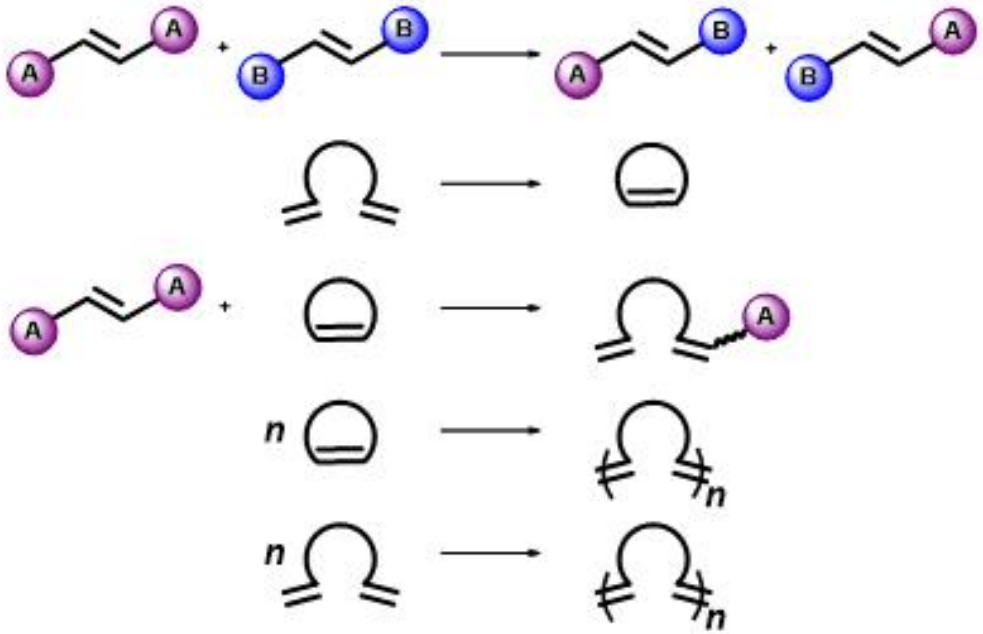
PRODUCT - metathesis catalysts

State-of-the-art, reaction-specific metathesis catalysts, enabling novel synthetic pathways and develop **economically and environmentally sustainable chemistry solutions.**

SERVICE - industrial process development

Through co-creation services, **we help our clients fully unleash the potential of olefin metathesis** in their production processes.

Our Focus: Olefin Metathesis



Cross Metathesis *(CM)*

Ring Closing Metathesis *(RCM)*

Ring Opening Metathesis *(ROM)*

Ring Opening Metathesis Polymerization *(ROMP)*

Acyclic Diene Metathesis polymerization *(ADMET)*

Application

Flavor & Fragrance

Pharmaceutical

Rubber

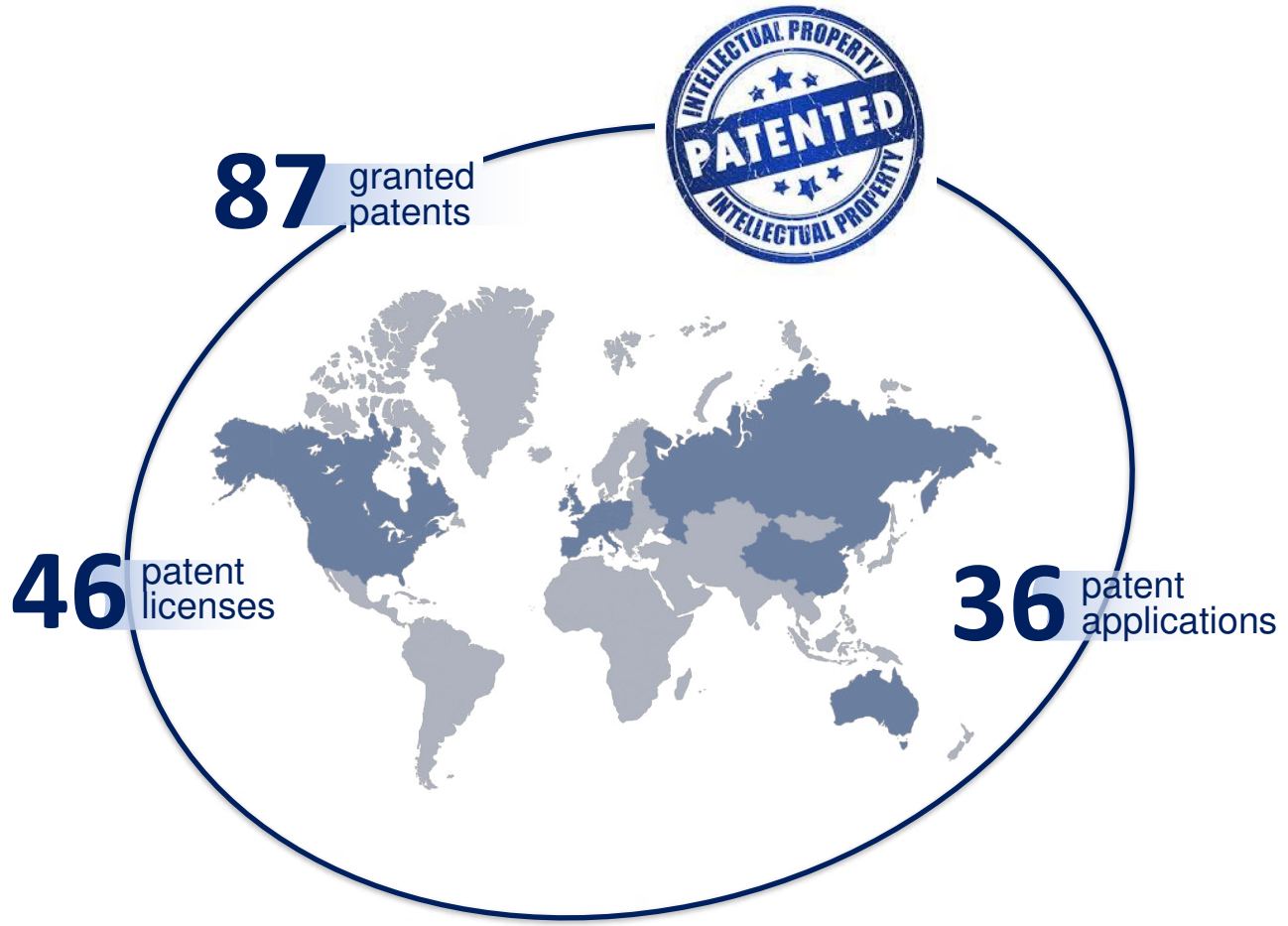
Polymer

Renewable chemicals

Paper additives

Specialty chemicals

Product and IP



Proprietary catalysts covering major European, North American and Asian markets

Lab & Equipment

Apeiron operates from a **400 m² laboratory** at Wrocław Technology Park.

The company uses **state-of-the-art lab equipment**

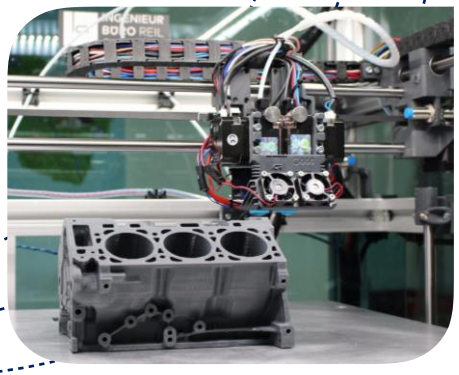
We help our partners make a difference in the world.

Healthcare

benign and cheaper methods for the production of new generation drugs

Decreased fossil fuel reliance

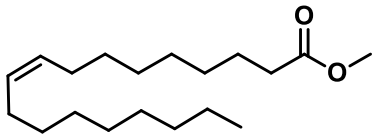
high value chemicals derived from renewable feedstocks



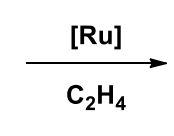
Advanced materials

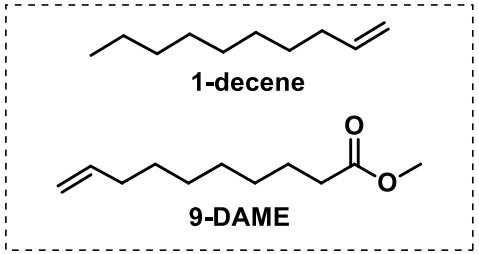
materials with enhanced properties applicable in innovative processes

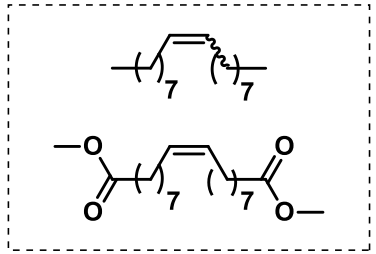
Plant oil ethenolysis



FAME from plant oil
0.8 – 2 USD/kg







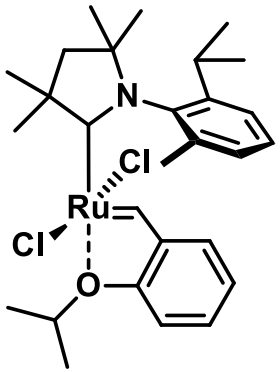
Desired price for 9-DAME:
~4-10 USD/kg

Catalyst requirements:

- **Stability in the presence of ethylene**
- **Selectivity towards CM with ethylene**
- **High efficiency (preferred >300,000 TON)**

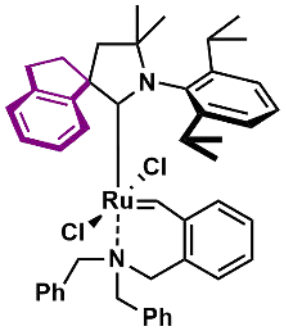
- Polymers
- Fragrance industry
- API - building blocks
- Lubricants
- Surfactants

Ethenolysis – Novel Spiro CAAC catalyst: SlashCat



- Not commercially available
- Expensive, not readily available substrates

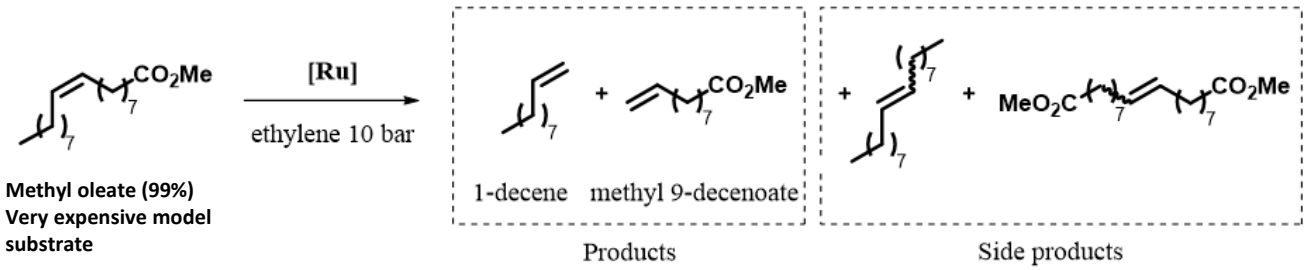
- 340 000 TON (1 ppm Ru)



SlashCat

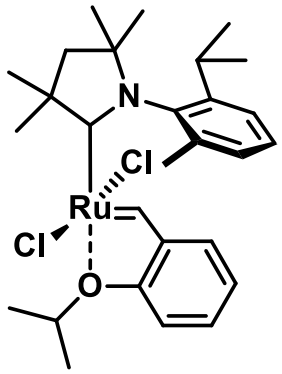
- Commercially available in kg quantities
- Readily available substrates
- Exceptional stability and long lifetime in reaction conditions

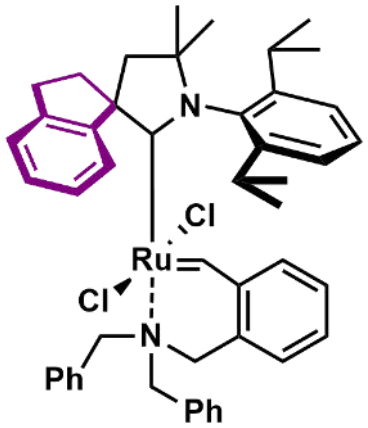
- 574 000 TON (1 ppm Ru)
- 848 000 TON (0.5 ppm)
- 1 260 000 TON (0.25 ppm)



Methyl oleate (99%)
Very expensive model substrate

Ethenolysis – Industrial friendly feedstocks





Sunflower oil FAME:

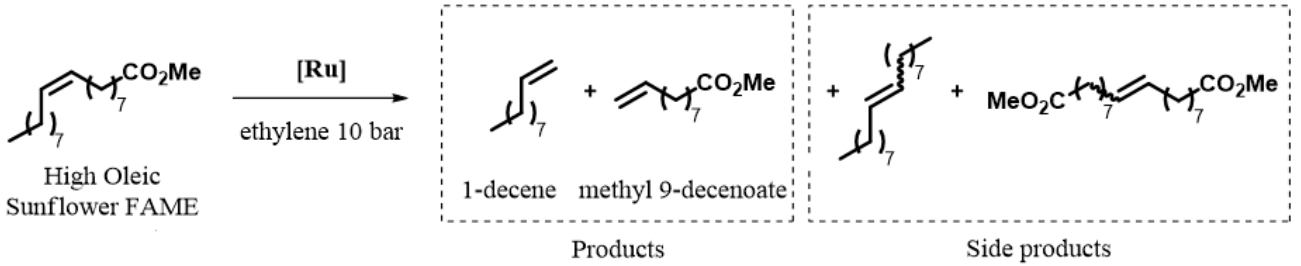
- **171 000 TON (1 ppm Ru)**

- **461 000 TON (1 ppm Ru)**
- **582 000 TON (0.5 ppm Ru)**

Rapeseed oil FAME:

- **148 000 TON (1 ppm Ru)**

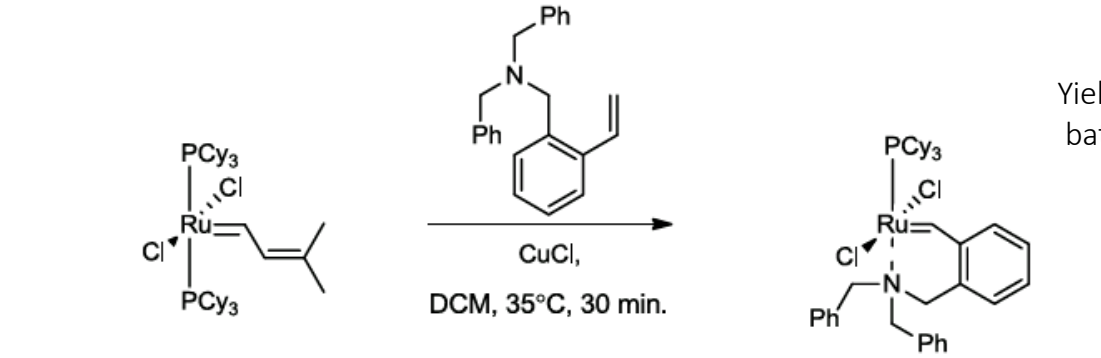
- **421 000 TON (1 ppm Ru)**
- **460 000 TON (0.5 ppm Ru)**



Reference: R. Gawin et al. "Inhibition of the Decomposition Pathways of Ruthenium Olefin Metathesis Catalysts: Development of Highly Efficient Catalysts for Ethenolysis" J. Am. Chem. Soc., 145, 45, 25010–25021 (2023).

POIR.01.01.01-00-0383/20

- Synthesis process scaled-up from laboratory to 250 L reactors
- Each step starting from raw materials (ruthenium chloride, indanone, aniline) optimized, yield and isolation methods improved



Yields and quantities of batches obtained in 250 L reactor:

80% (18.6 kg)

91% (17.1 kg)

SlashCat

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European Regional Development Fund

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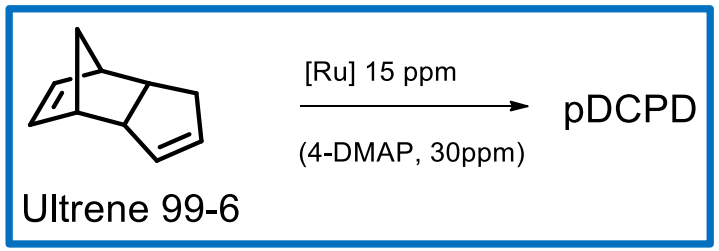
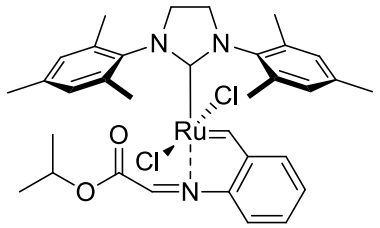
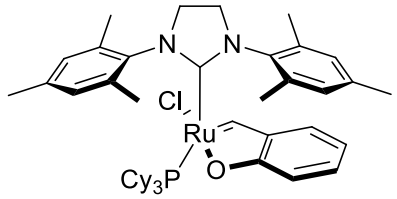
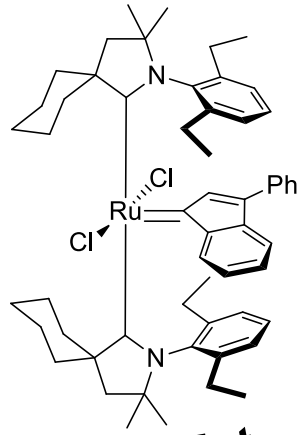




HeatMet



LatMet



UltraLatMet

Catalyst		Processing temperature [°C]	Curing time [min]	Shore hardness [°D]	Tensile strength [MPa]	Tensile modulus [GPa]	Shelf life at RT [h]	Shelf life at RT [weeks]
HeatMet		60	9:00	87.3	51.3	1.80	2:45	0.015
	+ 4-DMAP	65	6:50	87.8	51.8	1.90	9:30	0.054
LatMet		>130	-	-	-	-	20	0.12
	+ 4-DMAP	>130	-	-	-	-	60	0.36
UltraLatMet		95	22:20	80-85	38.8	1.87	11	0.065
	+ 4-DMAP	95	31:50	75-83	35.1	1.95	180	1.07

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UltraLatMet for ROMP

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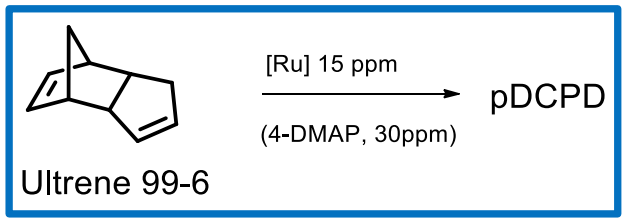
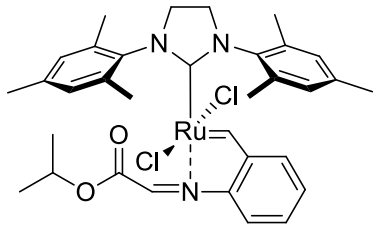
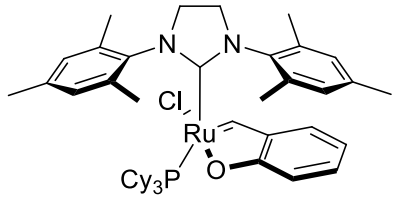
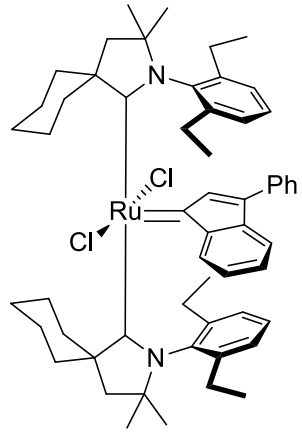




HeatMet



LatMet



UltraLatMet

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LatMet		>130	-	-	-	-	20	0.12
	+ 4-DMAP	>130	-	-	-	-	60	0.36
UltraLatMet		95	**22:20**	80-85	38.8	1.87	11	**0.065**
	+ 4-DMAP	95	**31:50**	75-83	35.1	1.95	180	**1.07**

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UltraLatMet - Latency

ULM [ppm] with 2eq of 4-DMAP in the monomer	Viscosity [cP]					
	t=0	24h	48h	72h	6days	4weeks
40	5.01	5.15	5.75	6.80	10.14	33.4
100	5.02	5.15	5.53	5.96	7.68	8.74
1000	5.11	5.28	5.37	5.39	5.70	6.98

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UltraLatMet - Latency

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	t=0	24h	48h	72h	6days	4weeks
40	5.01	5.15	5.75	6.80	10.14	33.4
100	5.02	5.15	5.53	5.96	7.68	8.74
1000	5.11	5.28	5.37	5.39	5.70	6.98

Shelf life >6months

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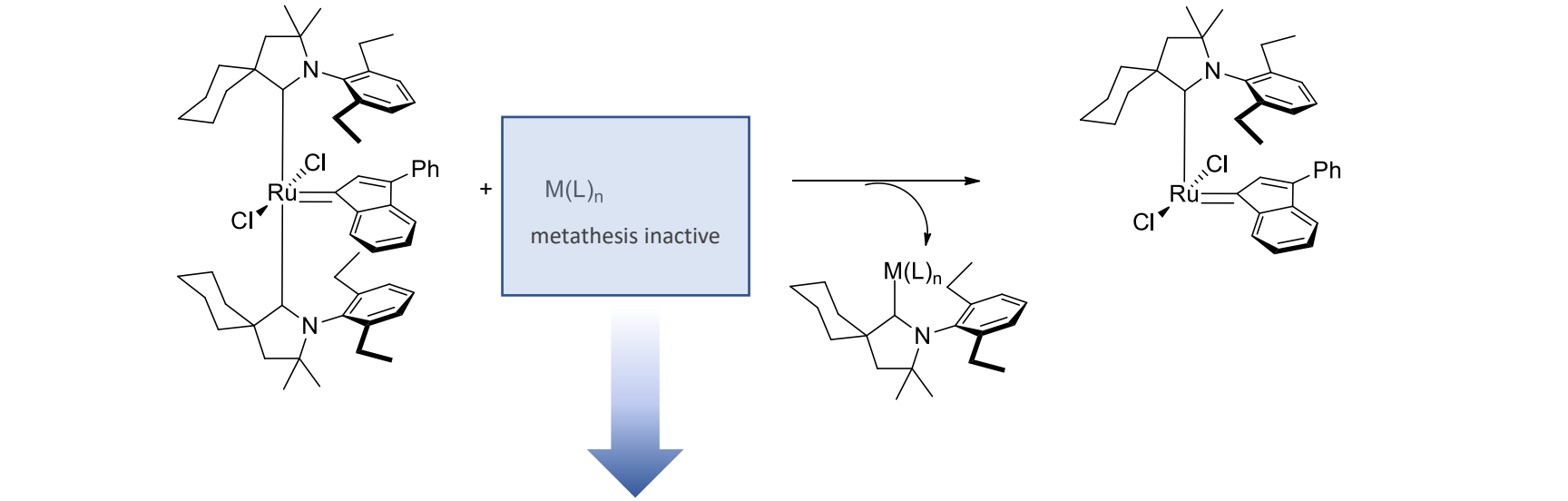
UltraLatMet - Latency



Fast RT curing

Temperature controlled curing

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ROMP in different conditions

Monomer	Formulation composition for 100g of monomer	Mold temperature* [°C]	Gel time** [min:sec]	Curing time** [min:sec]
Dicyclopentadiene* **	18mg AS2098-D1 + 19mg **co-cat C8**	23	Liquid after 60 days	-
		80	41:00	-
		90	13:00	33:00
	18mg AS2098-D1 + 19mg **co-cat C7**	23	120:00	-
		80	5:30	13:00
	18mg AS2098-D1 + 1,75mg **co-cat C6**	23	1:20	2:20
		50	0:14	1:30

* 10g of formulation in glass vial in oil bath
** gel time and curing time depends on monomer purity
*** the results were obtained for *Ultrene 99-6* dicyclopentadiene monomer

Apeiron synthesis

Leading the way in metathesis

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