Catalysts for Supercritical Hydrodeoxygenation

BL2F Final workshop, 6th March 2024

Luděk Meca, Ranido

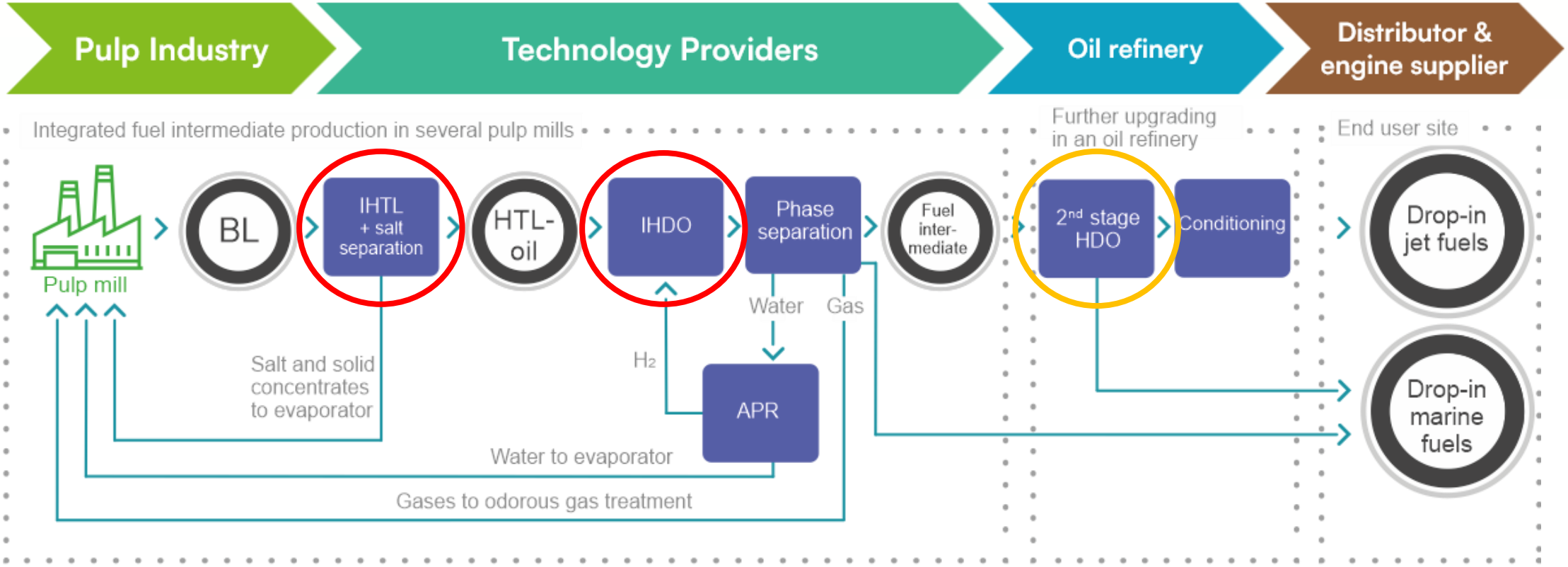
Ranido

BL2F

Transforming Black Liquor to Biofuel

This project has received funding from the European Union Grant Number 884111

BL2F Project



Three subsequent catalytic steps:

IHTL → IHDO → 2nd stage HDO (upgrading)

~380 °C
~220 bar
Supercritical or near-to-super-critical water conditions (red)

~300 °C
~30 bar
Usual pressure (orange)

This project has received funding from the European Union Grant Number 884111

BL2F – Catalyst for IHDO

Catalyst key features

- Stability under SCW (supercritical water) conditions
- Good activity & selectivity
- Low sensitivity to impurities / by-products
- Life-time (suppressed deactivation)

This project has received funding from the European Union Grant Number 884111

BL2F – Catalyst for IHDO

Support selection

- Stability evaluated under SCW (supercritical water) in a stirred autoclave
- Selection based on crush strength and BET surface changes

Sample description	Crush strength (N)		BET surface (m^2/g)		SCW stable
	Before	After	Before	After	
α-Al_2O_3	**100**	**101**	**1.8**	**2.2**	**yes**
TiO_2 (rutile)	**53**	**46**	**3.6**	**3.7**	**yes**
β-SiC (silicon carbide)	**234**	**125**	**27**	**28**	**yes***
activated carbon	**140**	**134**	**890**	**798**	**yes**
monoclin. ZrO_2	62	11	56	47	no
monoclin. ZrO_2	27	4	102	47	no
monoclin. ZrO_2	34	15	65	46	no
monoclin. ZrO_2	69	11	40	47	no
monoclin. ZrO_2	**128**	**111**	**14**	**13**	**yes**

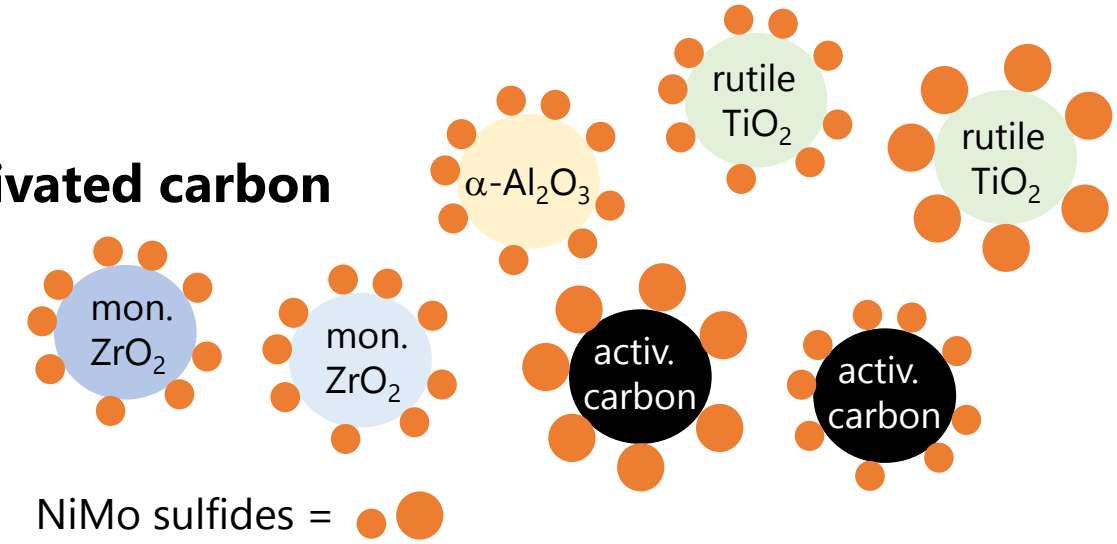
* Decrease in a crush strength

This project has received funding from the European Union Grant Number 884111

BL2F – Catalyst for IHDO

Support impregnation

- **NiMo on α-Al_2O_3, rutile, monoclin.-ZrO_2 and activated carbon**
  - Leached NiMo under SCW flow conditions



- **Ru on activated carbon**

  - SCW stable
  - Very good HDO results on model compounds even after catalyst poisoning with sulfur
  - This catalyst is available from Ranido in hundred kg quantities (trade name RCAT®-8830)

This project has received funding from the European Union Grant Number 884111

Summary and Outlook

Where we are now

- Working catalyst for IHDO on lab scale – Ru on activated carbon
- Five SCW stable supports ready for impregnation

Future challenges beyond BL2F project

- Additional bench-scale testing of IHDO of HTL-oil using Ru on activated carbon
  - Testing other possible SCW stable catalysts (e.g. Ru on monoclin.-ZrO_2)
- Verification at pilot scale testing unit

This project has received funding from the European Union Grant Number 884111

Thank you!

Get in touch with the project:

- Coordinator: Prof. Dr. Tero Joronen, Tampere University
- Website: www.bl2f.eu

 hello@bl2f.eu  @BL2F_EU  BL2F_EU

This project has received funding from the European Union Grant Number 884111