

## Novel, patent-pending single site catalyst for producing disentangled ultra-high molecular weight polyethylene (dis-UHMWPE)

### EXECUTIVE SUMMARY

CSIR-NCL has developed a novel catalyst system to manufacture highly crystalline, disentangled ultra-high molecular weight polyethylene (dis-UHMWPE). The dis-UHMWPE (form of UHMWPE) is a specialty material that allows manufacturing of oriented shapes (tapes & fibers) without solvent processing. Catalytic polymerization is demonstrated at 3 liters scale.

### BACKGROUND

- Ultra-high molecular weight polyethylene (UHMWPE) used in many applications requiring outstanding fracture/impact resistance, low friction & wear resistance properties
- UHMWPE is also used to make fibers & tapes using solvent processing techniques. Key producers are Honeywell, DSM & Teijin
- Currently catalyst based technology for producing dis-UHMWPE is available only with very few manufacturers & alternative catalytic technologies are in demand

### TECHNOLOGY KEY FEATURES

- CSIR-NCL has developed a novel catalyst system to manufacture highly crystalline, disentangled ultra-high molecular weight polyethylene (dis-UHMWPE)
- Catalyst: Heterogeneous, single-site catalyst
- Product:
  - UHMWPE powder
  - Enhanced crystallinity: 84 %
  - Molecular weight (Mw): 2-13 mil g/mol
  - Melting point: 141-144 °C
  - Melting peaks: 2 separate, & High at 144°C
  - Density (g/cc): 0.97 g/cc

### MARKET POTENTIAL

- The global UHMWPE fiber market is likely to grow from 618.2 (2019) to 824.6 million \$ (2025) with a CAGR of 7.5 %<sup>1</sup>

### VALUE PROPOSITION

- Novel, patent-pending catalyst
- One-pot, two-step catalyst synthesis process
- Producing raw materials for melt processing of UHMWPE into oriented forms

### APPLICATIONS

- Tapes & fibers of UHMWPE: Ballistic protection for defense, military, body armor, helmets, protective clothing
- Others: Cargo containers, aquaculture nets, ropes & cables

### TECHNOLOGY STATUS

- Catalytic polymerization is demonstrated at the scale of 3 liters
- Patent filed: [IN201711035497](https://patent.in/patent/IN201711035497), [WO2019069328](https://patent.in/patent/WO2019069328)
- Technology & patents are available for licensing/co-development

### REFERENCES

1. <https://www.lpinformationdata.com/reports/233923/global-ultra-high-molecular-weight-polyethylene#description>

Macromolecules 2018, 51, 12, 4541-4552  
(<https://doi.org/10.1021/acs.macromol.8b00590>)

