# Continuous process for manufacturing precision Silver Nanowires at scale

## EXECUTIVE SUMMARY

*CSIR-NCL has developed a continuous process for manufacturing of silver nanowires with precise control on the dimensions. These silver nanowires are important raw material for making conducting inks and flexible transparent conductive films. CSIR-NCL has demonstrated this technology at 500 gm/day. It can be scaled up easily to 5 kg/day and further.*

## BACKGROUND

- Silver nanowires are raw materials used in manufacturing conducting inks and flexible transparent conductive films (cost effective alternative to indium tin oxide (ITO) films)
- These applications require large quantity of silver nanowires with precise control on dimensions

## TECHNOLOGY DESCRIPTION

- NCL scientists have developed a continuous process for manufacturing silver nanowires with precise control on diameter and length

- Silver nanowires of the following specifications can be achieved:

✓ Length: 50-200 µm
✓ Purity: >99.5%
✓ Diameter 3 ranges: 30-40/50-60/80-100 nm
✓ Appearance: Gray suspension in solvent (Water/ Ethanol/Iso-propyl alcohol)

- The process technology is continuous and scalable process that recycles unreacted reactants efficiently

## MARKET POTENTIAL

- The silver nanowires is expected to grow at 27.5% CAGR by 2025*
- The demand of silver nanowires as replacement to expensive ITO films to make flexible transparent conductive films (used in touchscreen displays) which are used in touchscreen is expected to cross USD 200 Million by 2025*

*https://www.globenewswire.com/news-release/2019/07/25/1887775/0/en/Silver-Nanowire-Market-Forecasts-show-27-5-CAGR-USD-1-5-bn-Value-by-2025-Global-Market-Insights-Inc.html

## VALUE PROPOSITION

- Continuous & scalable manufacturing process
- Precise & reproducible control on dimensions
- High volume production is possible
- On demand Production.

## APPLICATIONS

- **Flexible transparent conductive films:** High-intensity LEDs, touchscreens, conductive adhesives, solar, sensors
- **Conductive silver ink:** Printed electronics (PE), flexible electronics (FE)
- **Antimicrobial:** Paint, cosmetics, bandages, clothing, water purification
- **Others:** catalysts, adhesives, polymers

## TECHNOLOGY STATUS

- Demonstrated and validated at 500 gm/day scale
- The process can be scaled up to 5 kg/day and further
- Technology and patents are available for licensing
- **Patent Pending:** WO2019049172, IN201711031533