

ZnoNova Technical & Commercial Dossier

Technical Data Sheet (TDS): High-Purity Nano-Platinum HER Electrocatalyst

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Product Code: SP-B00101 / ZNO-CAT-PT992 (Top Nano Lab Ref SP-B00101 · ZnoNova Export SKU ZNO-CAT-PT992)

Effective Date: October 2026

Manufacturer / Export Desk: Guangzhou ZnoNova Technology Development Co., Ltd.

Technology Partner: Top Nano Technology Co., Ltd. (Taiwan, Dr. Wen-Li Zhang)

1. Product Description & Primary Functional Role

ZnoNova SP-B00101 / ZNO-CAT-PT992 is an ultra-pure ($\geq 99.2\%$), unsupported metallic nano-platinum (Pt) powder specifically engineered as a high-activity cathode electrocatalyst for the **Hydrogen Evolution Reaction (HER)** in water electrolysis systems.

Synthesized via proprietary chemical liquid-phase reduction developed in collaboration with Dr. Wen-Li Zhang (Top Nano Technology Co., Ltd.), SP-B00101 / ZNO-CAT-PT992 exhibits monodisperse sub-10 nm crystallite morphology (2.5–5.0 nm primary TEM crystallites; 5–9 nm XRD Scherrer domain, typical 6.8 nm) with preferential exposure of high-index Pt facets, delivering exceptionally low overpotentials and sustained durability under high-current-density electrolysis operations.

2. Chemical & Physical Specifications

Analytical Parameter	Specification Baseline	Typical Measured Value	Analytical Method
Platinum (Pt) Purity	≥ 99.20 wt%	99.35 wt%	ICP-OES (Inductively Coupled Plasma)
Physical Appearance	Black, ultra-fine uniform powder	Conforms	Visual Inspection
CAS Number	7440-06-4	Conforms	—
Primary Crystallite & Domain Size	2.5 – 5.0 nm (TEM) · 5 – 9 nm (XRD)	3.8 nm (TEM) / 6.8 nm (XRD)	HR-TEM & XRD (Scherrer Equation, Pt (111))
Metallic Impurity - Fe	≤ 50 ppm	22 ppm	ICP-OES
Metallic Impurity - Cu	≤ 30 ppm	14 ppm	ICP-OES
Metallic Impurity - Ni	≤ 25 ppm	11 ppm	ICP-OES
Metallic Impurity - Pb	≤ 10 ppm	< 3 ppm	ICP-OES
Total Non-Pt Metals	≤ 0.80 wt%	0.65 wt%	Sum of ICP-OES trace metals
Loss on Drying (105°C, 2h)	≤ 0.50 wt%	0.28 wt%	Thermogravimetric Analysis (TGA)
Tap Density	1.8 – 2.4 g/cm ³	2.1 g/cm ³	ISO 3953

3. Electrochemical HER Performance (Standard Half-Cell Test)

Electrochemical activity tested using Rotating Disk Electrode (RDE) configuration in 0.5 M H₂SO₄ electrolyte, saturated with high-purity N₂ at 25°C:

- **HER Overpotential (η_{10}):** < 35 mV @ 10 mA/cm² (Typical: 28 – 32 mV)

- **Tafel Slope:** 28 – 32 mV/dec (Indicates rapid Volmer-Tafel proton recombination mechanism)
- **Mass Activity:** $\geq 1.4 \text{ A/mg}_{\text{Pt}}$ @ 50 mV overpotential
- **Durability (Accelerated Stress Testing - AST):** Retains $> 92\%$ of initial Electrochemical Active Surface Area (ECSA) after 10,000 continuous potential cycles (0.05 V to 1.0 V vs. RHE @ 100 mV/s).

4. Ink Formulation & Coating Guidelines

SP-B00101 / ZNO-CAT-PT992 is supplied as an unsupported dry powder that is readily dispersed into stable catalytic inks for membrane electrode assembly (MEA) fabrication:

1. **Solvent System:** Recommended ratio of 1:1 to 3:1 Isopropanol (IPA) to Deionized Water ($18.2 \text{ M}\Omega \cdot \text{cm}$).
2. **Ionomer Addition:** Compatible with Nafion™ D520 / D521 or Aquivion® perfluorosulfonic acid (PFSA) ionomer dispersions. Recommended Ionomer-to-Catalyst (I/C) weight ratio: **0.25 to 0.40**.
3. **Dispersal Protocol:** Pre-wet the powder with DI water first (Wet-First anti-ignition protocol), add IPA, followed by ionomer. Disperse using an ultrasonic bath or horn sonicator with ice-water cooling (20–40 kHz, 30–45 min) to maintain bulk temperature $< 25^\circ\text{C}$ and prevent solvent volatilization.
4. **Deposition Techniques:** Suitable for ultrasonic spray coating (Catalyst Coated Membrane - CCM), slot-die coating, screen printing, or gas diffusion layer (GDL) coating.

5. Strict Scientific & Application Boundary Disclosure

To ensure complete engineering transparency with commercial electrolyzer OEMs and academic research groups:

- **Cathode Role Only (HER):** Platinum is exceptionally efficient for cathodic Hydrogen Evolution. It is **NOT** an Oxygen Evolution Reaction (OER) catalyst and **CANNOT replace anode Iridium (Ir / IrO₂)** in acidic PEM electrolysis.
- **Unsupported Powder & Custom Pilot Grades:** SP-B00101 / ZNO-CAT-PT992 is standard unsupported nano-platinum black powder. Custom carbon-supported grades (Pt/C 40 wt% and 60 wt% on Vulcan XC-72R / Ketjenblack EC-300J) and alkaline/AEM binary catalysts (Pd/CeO₂/C,

Pd/RuO₂/C) are available as custom R&D pilot synthesis batches upon request.

6. Sample Grants & Commercial Ordering

- **Sample Evaluation:** Standard 5g qualification samples supplied with batch-specific Certificate of Analysis (CoA) and ICP-OES trace element report.
- **Academic Grant Program:** Free 5g research samples provided to accredited university laboratories and national hydrogen institutes upon registration of research protocol.
- **Packaging:** Sealed argon-purged pharmaceutical amber glass vials (5g, 10g, 50g, 100g, 500g, 1000g).
- **Direct Technical Inquiry:** Alex, Director of International Business
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