TECHNICAL DATA SHEET

ZircoBlack™ ZrN-Ultrafine

1. Product Identification

- Product name: ZircoBlack™ ZrN-Ultrafine
- Chemical name: Zirconium Nitride
- CAS number: 25658-42-8
- Chemical formula: ZrN
- Material positioning: optical-functional ceramic material for black coating and masking architectures
- Physical form: cubic nitride ceramic powder; yellow, brown, to black appearance depending on grade and processing

2. Key Technical Properties

Property	Value
Primary Particle Size	25 - 45 nm
Molecular Weight	105.23 g/mol
True Density	7.0 - 7.2 g/cm3
BET Surface Area	25 - 45 m2/g
Solubility	Insoluble in water/solvents
Functional Identity	Conductive optical-functional nitride ceramic
Chemical Stability	Stable under normal storage; avoid strong oxidizers and high-temperature air exposure

3. Functional Role and Mechanism

Intended Technical Functions

- Optical-functional ceramic architecture for black coating systems
- Visible-light attenuation and optical masking functionality
- Conductive optical-functional coating material
- Electrically conductive nitride ceramic for optical-electronic systems
- Corrosion-resistant coating material where ceramic stability is required
- Non-carbon optical black component for selected UV-process-compatible systems

Mechanistic Description

- ZrN crystallizes in a rock-salt lattice with mixed metallic/ionic bonding.
- Intrinsic conductivity is supported by partially filled electronic states in the nitride ceramic lattice.
- The inorganic nitride phase may support visible reflection suppression and low-gloss attenuation when properly dispersed or deposited in a qualified coating stack.
- Optical and electrofunctional behavior should be treated as system-dependent, not as a powder-only specification.

TEL:86 731-8224 6688
FAX:86 731-8521 5868
Address: Room531, Tower C,
Hong Jing Ming Plaza, Shao Shan
North Road243, ChangSha, China.

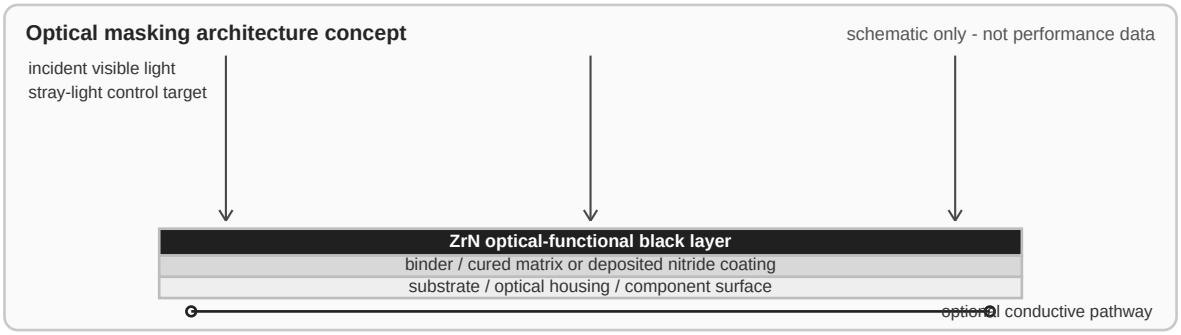
www.ruisunm.cn
czworkshop@icloud.com

4. Optical-Functional Positioning

ZrN can function as an optical-functional ceramic architecture for visible-light attenuation, optical masking, and conductive black coating systems. The material may support UV-process-compatible optical architectures requiring black optical surfaces with partial ultraviolet compatibility.

- Visible-light attenuation and low-gloss optical attenuation in formulated black layers
- Optical masking for camera-module interiors, sensor cavities, optical housings, and machine-vision assemblies
- UV-curable optical systems where dispersion, loading level, and cure response are validated by the user
- Black resist systems and photonic-processing-compatible black coatings
- Conductive optical-functional coatings where electrical behavior is part of the coating design
- Non-carbon optical-black systems where ceramic durability and nitride conductivity are preferred

Limitation: Optical behavior depends on formulation, loading level, film thickness, surface finish, substrate, and processing conditions.



5. Application Windows

Compatible Systems

- UV-curable optical coating systems after formulation and cure validation
- Optical masking coatings for camera modules, sensors, machine-vision optics, and optical housings
- Black resist systems and patterned optical/electronic coating workflows
- PVD / CVD optical-functional nitride coatings
- Conductive optical-functional coatings for optical-electronic assemblies

Processing Guidance

- Dispersion: Control agglomeration to maintain optical uniformity, masking consistency, and coating surface quality.
- UV-process compatibility: Validate resin chemistry, photoinitiator package, loading level, and film thickness in the final system.
- Coatings: Controlled atmosphere, such as vacuum or inert gas, is preferred for high-temperature deposition.
- Oxidation control: Oxygen pickup or surface oxidation may affect color, conductivity, and coating response.

Typical Use Scenarios

- Optical masking and stray-light management layers
- Low-gloss black optical coating architectures
- Camera-module, sensor, and machine-vision optical interiors
- Conductive black coating systems for optical-electronic components

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6. Critical Parameters and Failure Modes

Critical Control Parameters

- Particle size and dispersion state: Influence optical uniformity, surface finish, and coating density.
- Loading level and film thickness: Control optical attenuation, cure response, and electrical pathway formation.
- Oxygen content: Excess oxidation may degrade conductivity and color consistency.
- Processing atmosphere: Air versus inert conditions strongly affect stability at elevated temperature.
- Binder and substrate compatibility: Required for optical-process reliability and adhesion.

Known Failure Modes

- Agglomeration of fine powder causing non-uniform masking, haze, speckle, or surface defects
- Surface oxidation at elevated temperatures in air
- Loss of conductivity if partially converted to zirconium oxide
- Insufficient UV cure or uneven cure where loading level, film thickness, or photoinitiator package is not qualified

Application Limitations / Exclusion Zones

- Applications requiring specified low reflectance without measured coating data
- Applications requiring electrical insulation
- Long-term exposure in strongly oxidizing environments at high temperature
- Aqueous environments without protective matrices or binders

7. Handling, Storage and Stability

Handling

- Use in well-ventilated areas.
- Avoid dust generation; follow standard fine-powder handling practices.
- Use appropriate PPE to prevent inhalation and eye contact.

Storage

- Store in a cool, dry place in tightly sealed containers.
- Protect from moisture and strong oxidizing agents.

Stability

- Chemically stable under normal storage conditions.
- Not self-reactive; oxidation is possible at elevated temperatures.

8. Regulatory Notes and Disclaimer

- Regulatory status: Not listed as SVHC or carcinogen under major frameworks based on available information.
- Transport: Not classified as dangerous goods under standard ADR / IMDG / IATA when shipped as industrial ceramic powder.

Important note: This document is a Technical Data Sheet (TDS) and does not replace the product-specific Safety Data Sheet (SDS). Users must evaluate optical, electrical, processing, and regulatory suitability under their own formulation and application conditions.

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