

### Stannous Chloride Dihydrate / Silica Blends

High Purity. Enhanced Stability.

Reaxis manufactures and globally distributes high purity stannous chloride dihydrate ( $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ ; REAXIS® C154) and silica blended products (REAXIS® C154S and REAXIS® C154S+). Pure stannous chloride dihydrate is a white crystalline solid (Fig 1A) that is commonly employed as a potent reducing agent and catalyst. It is also utilized in various end-use applications including resin synthesis, electroplating, personal care, and water treatment. Stannous chloride dihydrate can be dosed into commercial processes in several forms: crystalline solid, melt, or solution (aqueous, acidic, methanolic, and ethanolic). Our silica blended products are formulated to excel in applications that require free-flowing powders.

The physical properties of stannous chloride dihydrate can present challenges to manufacturing processes that

require dry and free-flowing powders. The low melting temperature (i.e. 37 – 38 °C) and hygroscopicity tend to result in particle aggregation, which compromises the flowability and stability of the crystalline product. Our blended products, C154S and C154S+, aim to control product-moisture interactions and caking by combining our standard stannous chloride dihydrate with silica to enhance both flowability and thermal stability. These additives increase the host solids water repellency and reduce particle aggregation through physical adsorption (Fig 1B & 1C). This results in a product that remains stable throughout transportation, storage, and commercial manufacturing processes.

Addition of silica yields a product that has superior flowability compared to the pure host solid. As seen in

### TECHNICAL DATA

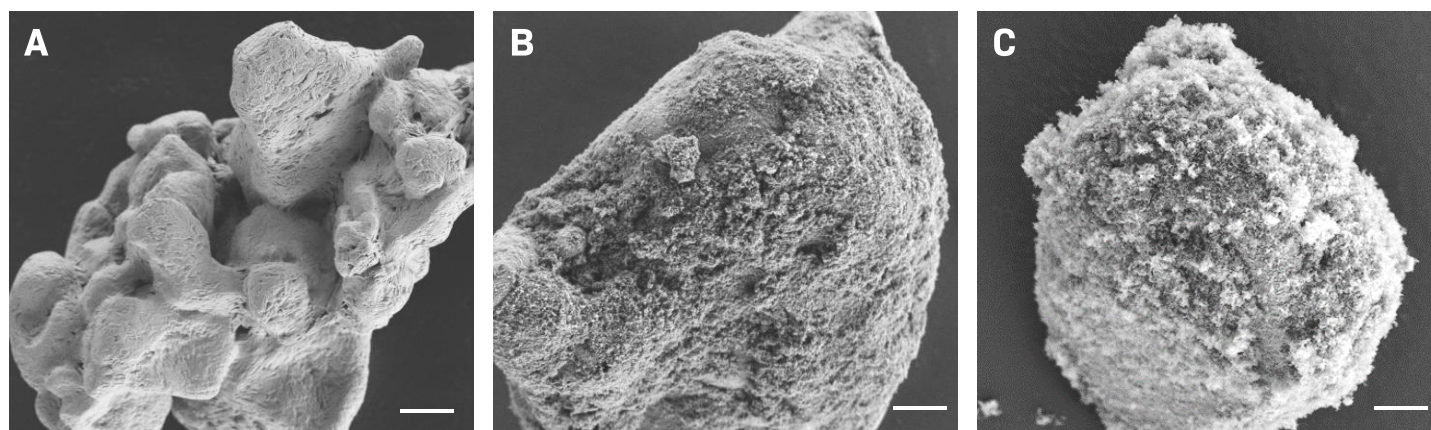


FIGURE 1. Scanning electron micrographs of pure host solid and silica treated solids. (REAXIS® C154 (A), REAXIS® C154S (B), and REAXIS® C154S+(C) under 2500X magnification (scale bar = 10 µm)).

TABLE 1. Properties and characteristics of stannous chloride dihydrate and silica blended products

REAXIS®	Assay as $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ (%)	$\text{Sn}^{2+}$ content (%)	Apparent Density (g/mL)*	Flow Rate (g/s)*	Flow Rate (g/s) after 24 h at 50 °C*	High purity	Flowability	Thermal stability
<b>C154</b>	99.0	52.1	1.16	No Flow	No Flow	●	○	○
<b>C154S</b>	97.5	51.3	1.38	30.2	No Flow	●	●	○
<b>C154S+</b>	97.0	51.0	1.06	7.1	6.1	●	●	●

\*Determined according to ASTM D1895-17



Table 1, the flow rate of the solids varies based on the identity of silica additive. Stannous chloride dihydrate does not flow without the addition of silica. The physical adsorption of micron-sized silica aggregates in **C154S** and **C154S+** results in a lower number of contact points and shape irregularities, which reduces interparticle friction. This leads to a product that has improved flowability. Comparison between silica blended products shows that **C154S** has superior flowability at room temperature (25 °C) compared to **C154S+**, ~30 g/s vs. ~7 g/s, respectively.

The quantity of adsorbed silica also influences the products apparent density. The scanning electron micrographs in Figure 1 clearly show an adsorbed layer of micron-sized silica aggregates in **C154S** and **C154S+**. Solid particles of  $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$  with minimal, but complete, coverage yield higher apparent densities compared to those with excess coverage, resulting from reductions in interparticle voidage and cohesion. For this reason, **C154S** has an apparent density of 1.38 g/mL, which is greater than that of the host solid, 1.16 g/mL. Particles with excess silica are expected to have a lower apparent density, which is observed for **C154S+** (i.e. 1.06 g/mL).

Thermally stable and free-flowing  $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$  can be obtained by delicately balancing silica quantity and grade. As seen in Figure 2, rapid melting is observed when pure  $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$  is exposed to temperatures  $> 38$  °C. Similarly, **C154S** melted within 2 h at 50 °C. After 24 h, the density of the product increased and separation of components was observed. **REAXIS® C154S** exhibits mild caking when exposed to temperatures  $\sim 38 - 40$  °C as show in Figure 3. The free-flowing properties of **REAXIS® C154S+** were maintained throughout thermal stability testing with a flow rates of  $\sim 6$  g/s after testing. **REAXIS® C154S+** utilizes a formulated silica that combats moisture sorption while supporting thermally stressed solids to minimize caking and melting. This behavior was not observed for **C154S**.

The Reaxis stannous chloride dihydrate product portfolio also includes alternative blends with additives such as polypropylene (**C154P**) and talc (**C154T**). Customized product design and sampling is available upon request.

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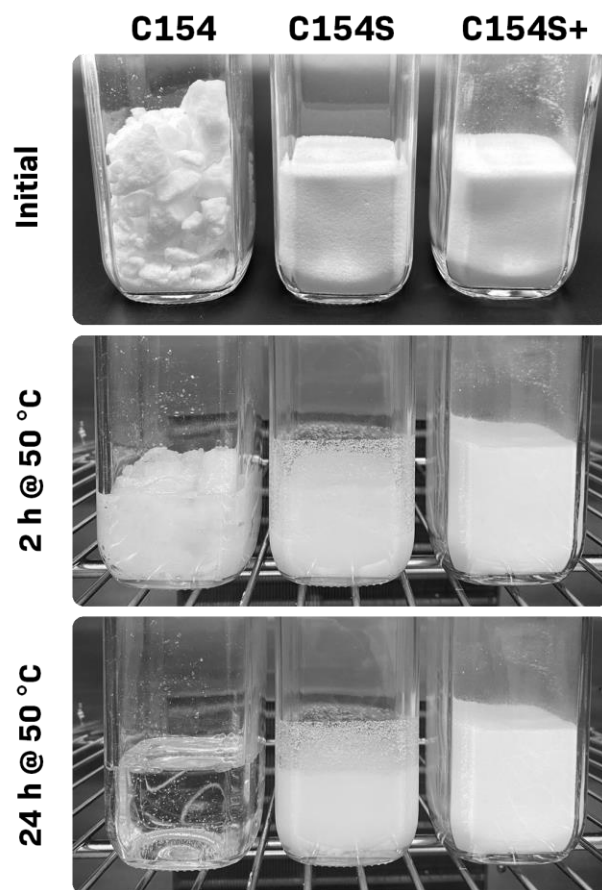


FIGURE 2. Thermal stability assessment of REAXIS® C154 (Left), REAXIS® C154S (Middle), and REAXIS® C154S+ (Right) after 2 h and 24 h at 50 °C and 50% RH.



FIGURE 3. Caking of REAXIS® C154S after exposure to 40 °C and 50% RH for 24 h. Caked solids are easily broken apart after compression.