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Rosin 101: The Critical Role of Rosin in Solder Paste Formulation and Enhancing Electronics Assembly Process Efficiency

Authored by: Dave Sbiroli, Indium Corporation.

Abstract

"A key ingredient that is critical to the solder paste formulation is rosin, which plays a significant role in enhancing the performance of the solder paste and hence providing high process yield."

In the complex domain of electronic assembly, the pursuit of perfection, efficiency, and high yield is ongoing. Manufacturers and assemblers continuously seek materials and processes that not only optimize production but also elevate the quality and reliability of the final products. One such material, often understated yet fundamentally critical, is solder paste.

Solder paste is a crucial enabling material in the electronics assembly process, serving multiple roles essential for effective production. Its functions include:

- Providing the alloy necessary for solder joint formation.
- Offering fluxing capabilities that prepare both the board and component surfaces for optimal wetting by molten solder.
- Delivering tackiness to secure components in place before the reflow process.

Solder paste is a blended combination of pre-alloyed solder powder and a flux vehicle, which is a homogenized formulation of all components utilized in the flux. A key ingredient that is critical to the solder paste formulation is **rosin,** which plays a significant role in enhancing the performance of the solder paste and hence providing high process yield.

This Rosin 101 was triggered by a recent question from our team, and I am going to cover the characteristics of rosin, its impact on solder paste performance, and its broader implications for the electronics assembly process.

Understanding Rosin: A Fundamental Component in Solder Paste

Rosin, also referred to as colophony, is a solid resin obtained through the distillation of pine trees. This natural substance is integral to solder paste.

Typically, the rosin content in a flux vehicle ranges from 30–50% by weight, depending on the specific formulation. Its natural origins imply that the properties of rosin are susceptible to environmental factors, such as soil, sunlight, moisture, and air quality, which can influence its chemical composition and performance characteristics.

DAVID SBIROLI

David Sbiroli is a Principal Engineer and the Technical Manager of Global Accounts at Indium Corporation. David joined Indium Corporation in 1993. He has more than 25 years of hands-on experience in the selection and applications of printed circuit board assembly materials and SMT process optimization, defect reduction, and troubleshooting on hundreds of Indium Corporation customers' SMT and electronic assembly production lines.

David has a bachelor's degree in Mechanical Engineering Technology from the State University of New York Institute of Technology. He is certified as an IPC Specialist for IPC-A-600 and IPC-A-610D.

David actively participates in the development of industry standards with the IPC and received the IPC's Distinguished Committee Service award for his work on the J-STD-004B (Requirements for Soldering Fluxes) standards.

email: sdbiroli@indium.com

Full biography: www.indium.com/biographies

The Importance of Rosin: Effects on Solder Paste Performance

> *"Variations in the rosin system including switching suppliers can lead to changes or inconsistency in end-of-line yields, given rosin's decisive influence on both print and reflow characteristics of solder paste."*

The importance of rosin in solder paste formulation is paramount. Variations in the rosin system, including switching suppliers, can lead to changes or inconsistency in end-of-line yields, given rosin's decisive influence on both print and reflow characteristics of solder paste. Below are the critical ways in which rosin affects solder paste performance:

Rheology and Print Performance

- **Viscosity:** Directly correlates with print performance and slump, influencing the efficacy of solder paste deposition on the board.
- **Stability:** Impacts stencil and shelf life, with potential reductions in both.
- **Tack:** The ability to hold components may change with variations in rosin.
- **Transfer Efficiency and Response-to-Pause Performance:** Related to printability and can be impacted.
- **Slumping:** Excessive cold or hot slump can aggravate defects, including bridging and solder shorts.
- **Printer Setup:** Differences in viscosity may necessitate adjustments in squeegee speed, pressure, separation speed, and understencil wiping frequency.
- **Paste Roll on Stencil:** Viscosity increase may cause solder paste to roll poorly on the stencil and stick to the blade excessively, which may cause interruptions to the production.

Reflow Process Efficiency

- **Oxidation Barrier Performance:** An increase in graping and inadequate small deposit coalescence can occur.
- **Head-in-Pillow (HIP) Defects:** These may increase due to reduced fluxing activity and capacity.
- **Solder Balling and Beading:** Poor coalescence, along with low viscosity and activity, can lead to these complications.
- **Increased Voiding:** Reduced wetting and weak coalescence can result in elevated voiding.
- **Poor Wetting and Decreased Spread:** Negatively affects the quality of solder joints.
- **Post-Reflow Residue:** The appearance may vary and ICT yields can decline. If cleaning occurs, residual ionic contaminants may increase due to the inherent difficulty in removing rosin-based residues.

Ready to Enhance Your Electronics Assembly Process?

If you're looking to troubleshoot or get a private seminar for your team, we are here to help. Contact us today for a consultation, and let us guide you through optimizing your production efficiency and solder joint quality!

Electrical Reliability

- **Surface Insulation Resistance (SIR):** The primary component of post-reflow residue is rosin. Any alterations in the composition of rosin can significantly affect the softening point and acid number, which may lead to a reduction in SIR values, particularly at elevated temperatures.
- **Solvent Mobility:** Within a no-clean flux system, rosin serves as an encapsulation layer over the solder joint and aids in mobilizing residual activators and solvents. Modifications to the softening point or other properties of rosin can increase solvent mobility, potentially resulting in leakage when the assembly operates under bias voltage in the presence of humidity.

Given these potential impacts, it is evident that any alteration in rosin types, suppliers, or a change in the source of pine trees utilized for rosin extraction can introduce inconsistencies, thereby affecting the overall solder paste performance and hence the electronics assembly process.

Ensuring Rosin Quality for Optimal Assembly Outcomes

Recognizing the critical function of rosin underscores the necessity of maintaining consistent quality in solder paste formulations. Manufacturers must meticulously monitor it to ensure the consistency of the products.

Additionally, monitoring the performance of solder paste through tracking yields and common defects can facilitate the prompt identification of issues related to rosin quality.

To summarize, although rosin may appear to be a minor component of solder paste, its impact on the electronics assembly process is substantial. Its role in ensuring the reliability, efficiency, and quality of solder joints makes it an indispensable element of the electronics manufacturing sector.

In light of this, we invite you to evaluate your current solder paste processes. Consider conducting a thorough assessment of your rosin sources and the quality of your solder paste formulations. Engage with our team of experts for tailored recommendations that can enhance your production efficiency and product quality. Don't leave your assembly outcomes to chance—contact us today to discuss how we can help you optimize your processes and achieve superior results in your electronics manufacturing operations.

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