

## Fluorescence measurement for design, optimisation and quality control of hairpin decoating in the production of electric motors.

**Product:** SITA CleanoSpector, SITA clean line CI  
**Industry:** Automotive (e-mobility)  
**Measuring principle:** Fluorescence measurement

The increasing use of electric drives in the automotive sector (e-mobility) leads to innovations in manufacturing processes. In order to produce highly efficient electric motors at low cost, rectangular copper wires (hairpins) are used, which are electrically and mechanically connected by laser welding. For this purpose, the insulation varnish of the copper wires must be removed from the surfaces to be joined. Residues of the insulation burn during welding, the gas development leads to pores and thus to quality problems. Furthermore, smoke can impair the laser and contaminate the welding laser optics.

### ● SITA CleanoSpector

The handheld measuring instrument SITA CleanoSpector is used to detect insulation residues on wires (e.g. polyimides, PEEK, PVC). Within the scope of the process design, the fluorescence measurement enables the determination of the optimal process parameters during the laser stripping for a sufficient ablation quality at the lowest possible cycle time.

In production the SITA CleanoSpector is used to randomly control the hairpins and to prevent quality problems in the follow-up welding process and in the manufactured electric motors. Process changes can thus be detected and compensated and thereby a permanently high quality can be achieved. Monitoring and documenting the decoating result helps to control the complex welding process with its numerous other influencing variables.

### ● SITA clean line CI

The high degree of automation of the production lines and the high quantities often result in the requirement to use a fully automatic in-line inspection system in series production. The SITA clean line CI inline measuring system is suitable for plant integration. The copper wire is conveyed as continuous material through the production line. Directly after stripping, the surfaces are inspected by the SITA clean line CI without loss of cycle time before the copper wires are cut to length, bent and later welded.

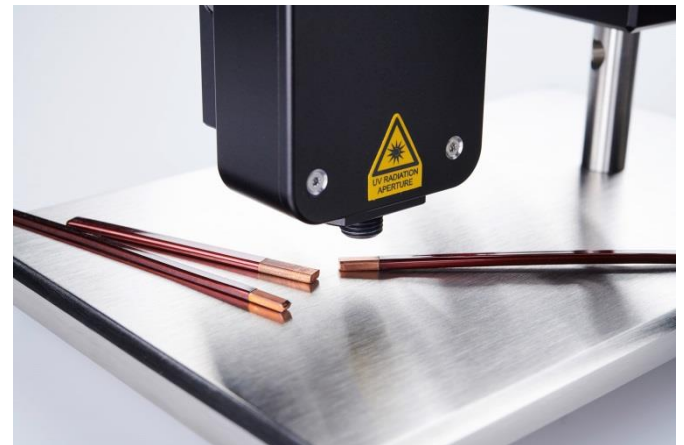


Figure 1: Cleanliness inspection of the Hairpins using the SITA CleanoSpector

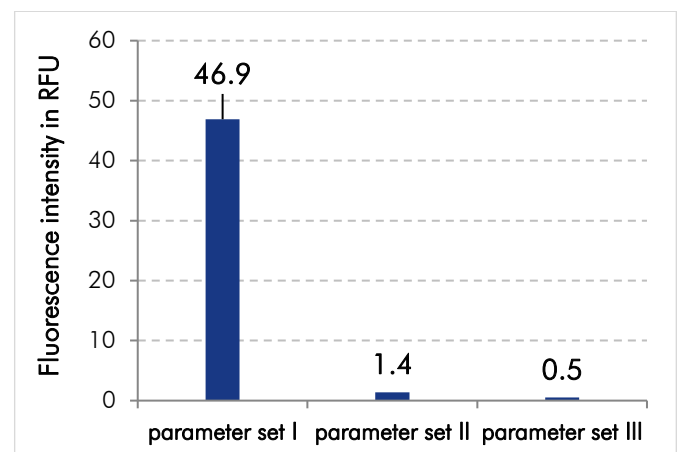


Figure 2: Results of the fluorescence measurement with different parameters of stripped hairpins