

Solder Flux Residue – Part 2

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Introduction

In Part 1, we mentioned that some of the constituents (e.g. Si, Ba, S) found in the EDS spectra of solder flux residue on a PCBA surface are likely due to the solder mask beneath the residue as the e-beam can penetrate through thin residue layers. Here we examine how to analyze EDS data to remove the contribution of the solder mask.

EDS Data

Fig. A shows solder flux residue between two PTH solder joints that were soldered using a solder fountain process. The corresponding atomic percentages of elements resulting from quantification of the EDS spectrum of the residue is shown in Fig. B.

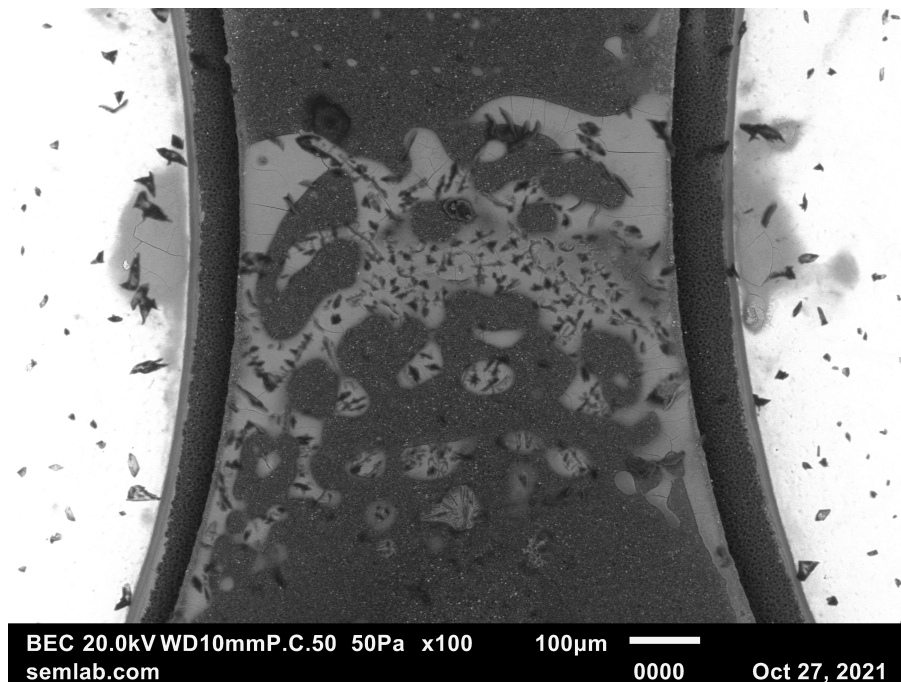


Fig. A - BSE SEM image of solder flux residue between two PTH solder joints.

Element	Flux Residue on Mask
C	54.9%
O	28.8%
Al	0.3%
Si	0.6%
S	0.7%
Cl	0.2%
Fe	0.1%
Cu	0.3%
Br	0.1%
Sn	13.4%
Ba	0.7%

Fig. B - Atomic percentages of constituents in solder flux residue on solder mask.

A reference spectrum of the solder mask was acquired from the component side of the board. The atomic percentages of elements associated with the solder mask are shown in Fig. C.

At this stage, we make the assumption that all of the barium in the flux residue EDS data (Fig. B) is due to the solder mask. This means that 35.1% of the flux residue EDS spectrum was due to solder mask beneath the residue. So, we can subtract that contribution off, which results in the following constituent percentages in the flux residue itself (Fig. D).

This data suggest that the residue is mostly flux resin or rosin and tin-oxides, which is typical. The Cl and Br are likely solder flux activators. The 0.3 at% Si may be an indication of silicone contamination perhaps from silicone lubricant used for the solder fountain piston or impeller. The 0.2 at% Fe may be due to dissolution of a steel nozzle or other iron-based materials in the solder fountain.

Element	Solder Mask
C	62.9%
O	31.1%
Al	0.1%
Si	1.3%
S	2.1%
Cl	0.3%
Fe	0.0%
Cu	0.3%
Br	0.0%
Sn	0.1%
Ba	1.9%

Fig. C – Atomic percentages of constituents in solder mask.

Element	Flux Residue, net
C	50.5%
O	27.5%
Al	0.4%
Si	0.3%
S	0.0%
Cl	0.1%
Fe	0.2%
Cu	0.2%
Br	0.1%
Sn	20.7%
Ba	0.0%

Fig. D – Net atomic percentages of constituents in solder flux

Summary

EDS spectra can be acquired and quantified for investigating problems, such as solder flux and dross residue sticking to solder mask after using a solder fountain process. In most cases, the EDS spectrum or quantified data are reported without further analysis. In this case, we were able to subtract the contribution of the solder mask constituents to the unknown residue spectrum for a refined look at the residue itself.