



### Frequency Agile Microwave Bonding System (FAMOBS)

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The research aimed to improve a prototype manufactured under the previously IeMRC feasibility study. The device is a variable frequency microwave heating oven used for encapsulation, underfills and small density interconnects. The equipment performed the RF-cure at high frequency for ICA bumps of tens of micron size and/or the cure at low frequency of encapsulants. The installation of this oven will be on the arm of a high precision placement machine for micron accuracy alignment capability and the RF-cure of underfills. Following many prototypes created for this oven, an optimum design has been selected and curing of paste materials has taken place. Closed feedback control of the heat dissipated (and the input power to be applied) was achieved using a thermal camera. Work is carried out to look at the impedance spectrum of various paste materials at different temperatures. The work of microwave curing of paste materials seems to indicate that the traditional curing models cannot be used readily for this application.

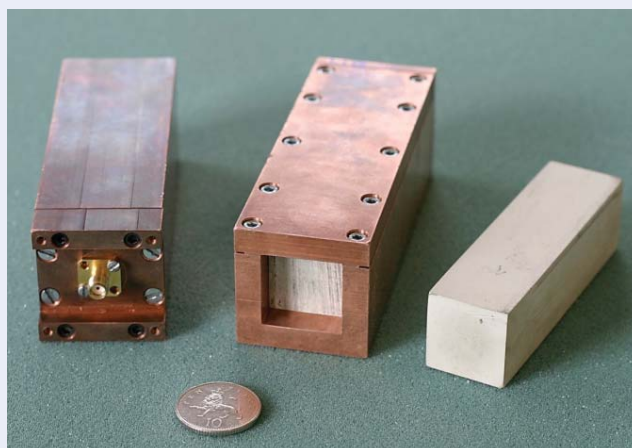


Fig. 1 – The FAMOBS open cavity oven

The prototype (fig. 1) of the 'open-ended' oven comprises a dielectric filled rectangular waveguide having a short circuit at the excitation end of the waveguide shown on the left of the photograph and an open circuit at the opposite end shown in the centre, such that the target package to which heat is to be applied, can be placed easily within the evanescent fields adjacent to the dielectric interface. The prototype has been specifically designed to provide a demonstration of the formation of multiple 'hot-spots' in the open-end (fig. 2). At a lower frequency of excitation, the oven can also be used to cure uniformly paste materials such as encapsulants.

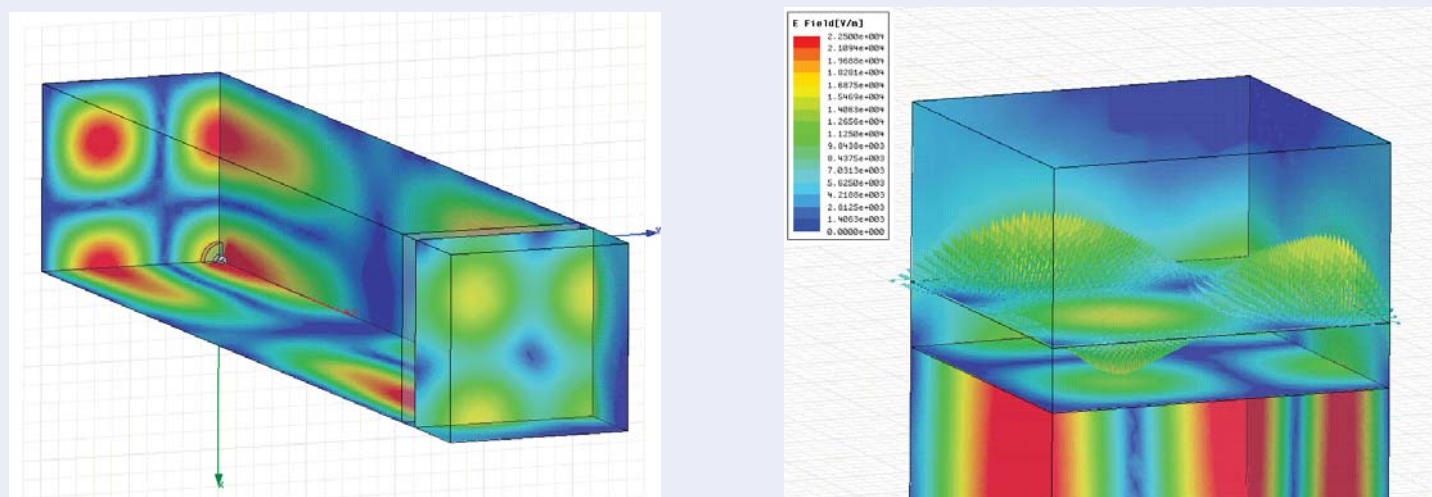


Fig. 2 Electromagnetic field distribution (1/4 of the model) using frequency selective surface and dielectric insert for maximum power output

The project demonstrated that a set of process conditions can be achieved so that variable frequency microwave heating and cure technology can be implemented successfully into electronic component manufacture, assembly and packaging. The optimum set of parameters for RF-curing is been looked at in collaboration between the two Universities and the industrial partners (Henkel Multicore, Bookham, Renishaw, MCE and NPL). This project enables the creation of a unique, patentable RF-cure apparatus for insertion into a novel bonding equipment that will permit a more efficient packaging technology.

The project has reached level 3 on the TRL scale. It is now continuing as a European Project with Heriot-Watt University, the University of Greenwich, the Fraunhofer Institute IPA (Stuttgart, Germany), and the EEI (Estonia) acting as Research and Technology Performers on behalf of a series of European Associations of SMEs.

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