Title:
A study of micro-scale solder bump geometric shapes using minimizing energy approach for different solder materials

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Abstract:
Demand for more interconnection joints between semiconductor devices can be realized with solder bump technology. Surface tension and density are usually material properties related factors that affect solder bump geometric shape. Therefore, to cope with this fast-changing microarchitecture design in semiconductor technology, a better understanding of the solder bump geometric shape is needed. This study used a static equilibrium force approach to integrate the surface tension and gravitational energy into the solder energy content. Surface Evolver software was used to perform calculations and deliver the final solder bump shape. Perfect agreement with less than 10 % comparison between previous studies and the current Surface Evolver results was found. According to statistical analysis using SPSS, the maximum width of solder shape is closely related to the surface tension. In contrast, the maximum standoff is highly correlated with the solder density. By changing the solder volume, the solder bump changes from standard flip-chip bump to Cu pillar bump with consistency in maximum width to maximum standoff height ratio of 1.5. This study shows that the bumping technology can produce various sizes of solder bumps to meet new electronic packaging requirements.