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3D printed smart structures

Large area support structures, containing sensors and fast, high density electronics requires effective cooling to be reliable. This is true for commercial gadgets, like computers, and even more so for XL scientific apparatuses like detector systems in accelerators, electron microscopy , synchrotron light sources , Xfels and more where outcomes could lead to fundamental discoveries and therefore require additional precision. At the moment cooling is either bulky, therefore potential source of secondary scattering and noise (Peltier cells), or not optimally effective in removing the local heat.

We propose to use recent advances in novel 3D printing materials to fabricate, SMART,low mass, low cost, silicon compatible and precise Ceramic support structures with embedded micro-channels for CO2 cooling. Aluminum Oxide and Aluminum Nitride, which can both be printed, have spectacular thermal propertied and are thermally compatible with silicon, are compatible with brazing and interconnect with either ceramic or metal pipe and have shown that details, like internal channels, can be as small as 200-500 microns respectively. FAST fabrication makes this proposal particularly attractive since tests and design optimization would be possible in a fraction of the present time and cost.

Summary

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