

Flash-Sintering+: Ultrafast Rates of Diffusion via Defect Generation

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Flash-Sintering is a method whereby many if not all oxides can be sintered in a few seconds at temperatures well below 1000°C by the application of electrical fields and currents. The sintering rates are five to seven orders of magnitude faster than conventional. New work has shown that flash processing also applies to refractory and main group metals. Recent work has shown that the onset of flash is accompanied by massive generation of defects, imaged in TEM, so much so, that they form their own crystal within the host. Sheets of vacancies are believed to instill electronic conductivity in ionic solids and insulators. Rapid diffusion is leading to new applications of flash, now called flash-sintering+, including chemical reactions in solid state chemistry, e.g. conversion of ZnS into ZnO in a few seconds. Graphene infused copper has been produced by flash of copper wires coated with amorphous carbon, with 10% higher conductivity. Emerging applications include plasma enhanced catalysis. Commercial interest is starting to emerge. An up-to-date summary of these developments will be presented.