

Can a chondrule precursor survive a shock wave?

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A convincing model for chondrule formation mechanism is the shock wave heating model. When a chondrule precursor passes a shock wave, the precursor is heated by gas drag. Dynamic pressure due to a shock wave being capable of chondrule formation is in the range of 10-100Pa. I checked the possibility of destruction of a chondrule precursor followed by a passage of a shock wave, because a precursor is possibly a dust aggregate, which is porous and fragile material.

1) Destruction by the dynamic pressure

A chondrule precursor is not disrupted by the dynamic pressure unless the porosity of a precursor is larger than 99%. Dust chains at the surface of a precursor bend, but not detached from the surface.

2) Explosion due to evaporation of volatile materials

A dust particle contains silicates, organics, and ices roughly by same weights. Therefore, organics and ices will evaporate before silicates melt by gas drag heating. If the size of a precursor is larger than 10cm, the precursor explodes by gas pressure.

To summarize, a dust aggregate whose size is in the range of chondrules can survive a shock wave.