SHORT PRESSURE PULSE ORIGINATED SHOCK-VEINS IN NWA-4383 S4 STAGE ORDINARY CHONDRITE

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Introduction: Analysis of opaque shock-induced melt veins (shock veins) can reveal important features of shock metamorphism of meteorites [1]. NWA 4383 is an LL6 petrologic type S4 shock stage ordinary chondrite [2]. The sample contains characteristic network of thin opaque shock veins. Here we present petrographic, Raman microscopy and SEM study of this opaque vein network in order to reveal its formation conditions.

Results: Host rock is penetrated by shock vein network is composed by highly recrystallized chondrules, only few of them retained well-defined boundaries. They are predominantly of a porphyric type, only 10% of the chondrules are relict (radial pyroxene and barred olivine chondrules). Chondrules made by forsteritic olivines and ortho-enstatites with few recrystallized ones contain fine-grained diopside-enstatite cumulates. Small anhedral plagioclases occur intersticially among chondrules. Polygonal chromite grains and anhedral sulfide aggregates are also frequently occurring. The shock-induced veins have variable thicknesses from 10 to 120 μm although some parts reach 250 μm. They are opaque in transmitted light and have very sharp and straight contact with the host. The texture of the veins is characteristic with a microcrystalline silicate matrix surrounding blebs of metal-sulphide and host rock fragments are embedded in the matrix. Metal sulphides are mainly pirrhotite and mackinawite with 5-10 wt% Ni content. The microcrystalline silicate grains (<1 μm) are olivines and ortho-enstatites. Host rock fragments are well rounded olivine and enstatite grains with a diameter varying between 5-30 μm. Polygonal shaped iron chromite crystals and anhedral plagioclase phase are also occur in the veins subordinately. Sporadically irregular shape feldsphatic glass (albite glass) inclusions are observable in the microcrystalline matrix. Raman microscopy indicate that every phases in the vein (except albite glass) are exhibiting well crystallized structure and any difference between structure of minerals nor in the veins neither adjacent to the veins can be observed.

Conclusions: The low pressure mineral assemblages in and adjacent to the veins indicate that the crystallization of the veins may have been occurred after shock pressure release [3].The cataclastic texture indicates the presence of shock pressure, but lack of high pressure mineral phases and the presence of mineral glass inclusion reveal rapid decrease of shock pressure and temperature, thus shock wave loading expected in nanoseconds [4]. The presence of thin shock induced veins without high pressure polymorphs are proposed formation by single impact event, probably far from impact centre of small planetary body.

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