Shock Wave Induced Phase Transition from Crystal to Amorphous State of Lead Nitrate Crystal

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Details of shock loading experiment

The required shock waves are generated by an in-house semiautomatic Reddy Tube which is capable of producing shock waves up to Mach number 4.5. It has three sections such as driver, driven and diaphragm sections.The driver and driven sections are made of seamless steel tubes of 48 cm and 33 cm length, respectively and both have the same inner diameter of 1.5 cm. Atmospheric air is used as the working substance for the required shock wave generation which is supplied by a tabletop mini 1 HP air compressor that has the capacity of 8 bars pressure storage. The diaphragm section separates the driver section and the driven section. Carbonless paper diaphragms are fed into the diaphragm section with the help of a motor. While the atmospheric air is being compressed into the driver section, at the critical pressure, the diaphragm is ruptured such that the shock wave is generated and moves along the driven section. The schematic diagram of the shock tube is presented in Fig.1.

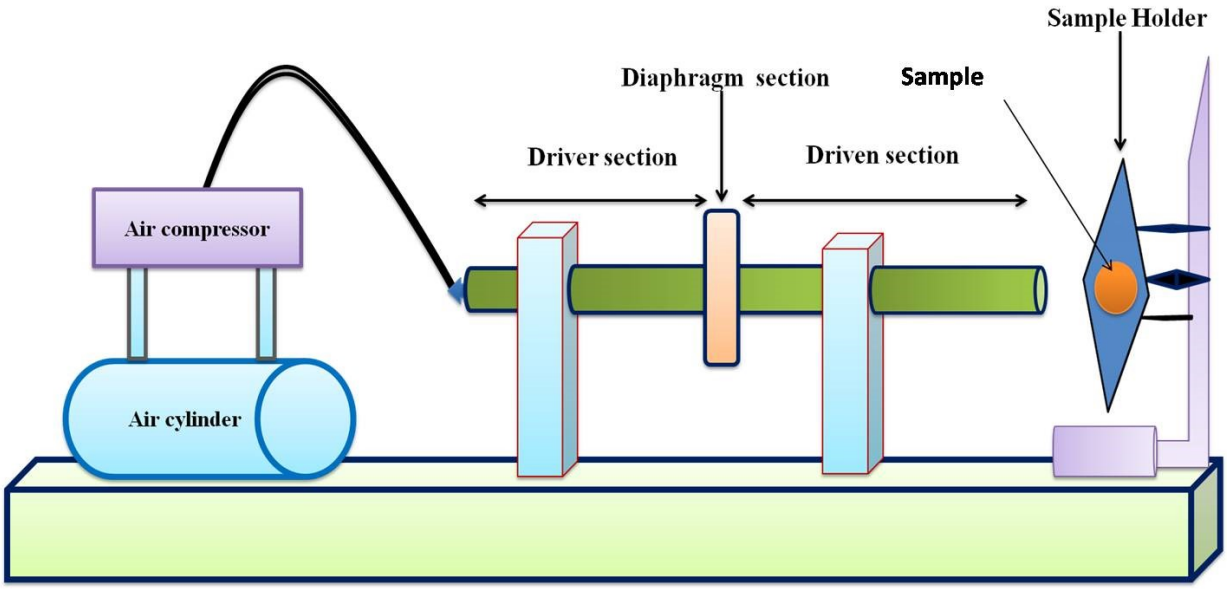

Fig.S1 Schematic diagram of the shock wave loading setup

One end of the driver section is connected to the diaphragm section which has two pneumatic cylinders and the other end is connected to the compressor. The pressurized air is also utilized for the operation of pneumatic cylinders. Using the pressure controller of the driver section, we can control the input pressure range of the driver section.

Operation of the shock tube

Pressure of the air in the driver section is gradually increased by the air compressor until the diaphragm ruptures which leads to the generation of shock wave traveling along the axis of the driven section. The required numbers of test samples are to be placed one by one in the sample holder which is typically placed 1cm away from the open end of the driven section. Subsequently, required numbers of shock pulses are loaded on the respective test sample with an interval of 5 sec between each shock pulse. 50 number of shock pulse means that the sample is exposed for 50 times by shock wave of a particular Mach number. After the completion of the shock wave loading experiment, the control and shock wave loaded samples are sent for analytical studies.

It is worth noting that the loading of static high-pressure is different from that of loading with dynamic shock transient pressure which has the pulse duration of few microseconds. In the case of static compression, pressure is increased gradually so that very high energy is required to induce structural changes in solids.

XRD Results

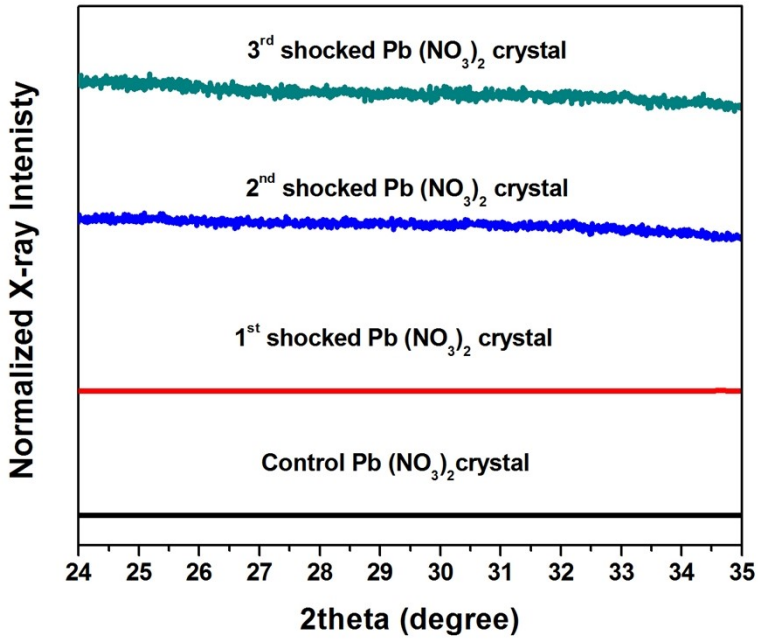

Fig.S2 XRD pattern baselines of control and shocked crystals

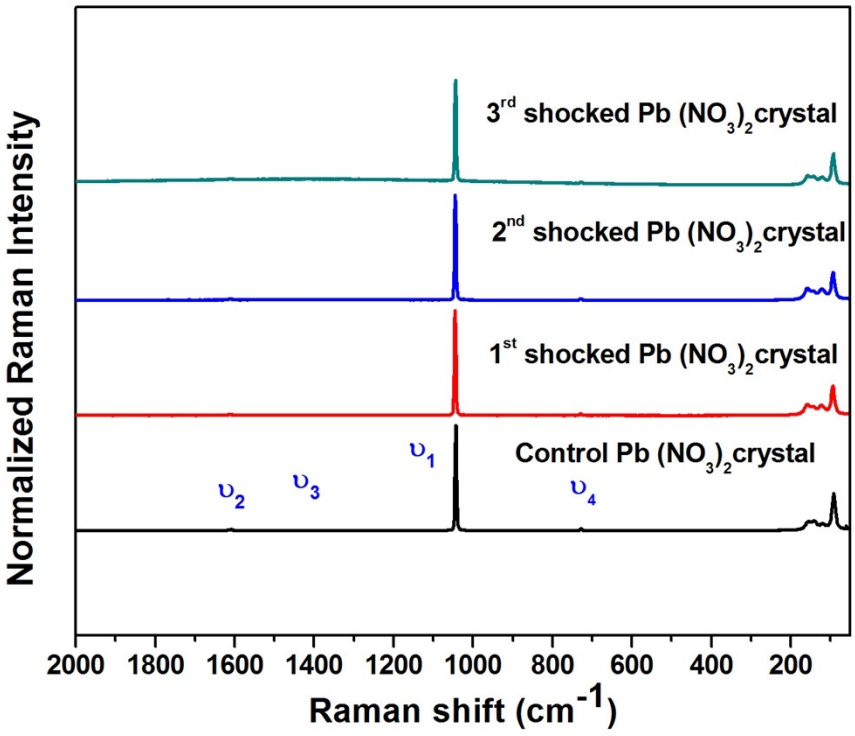

Fig.S3 Raman spectra of the control and shocked crystals

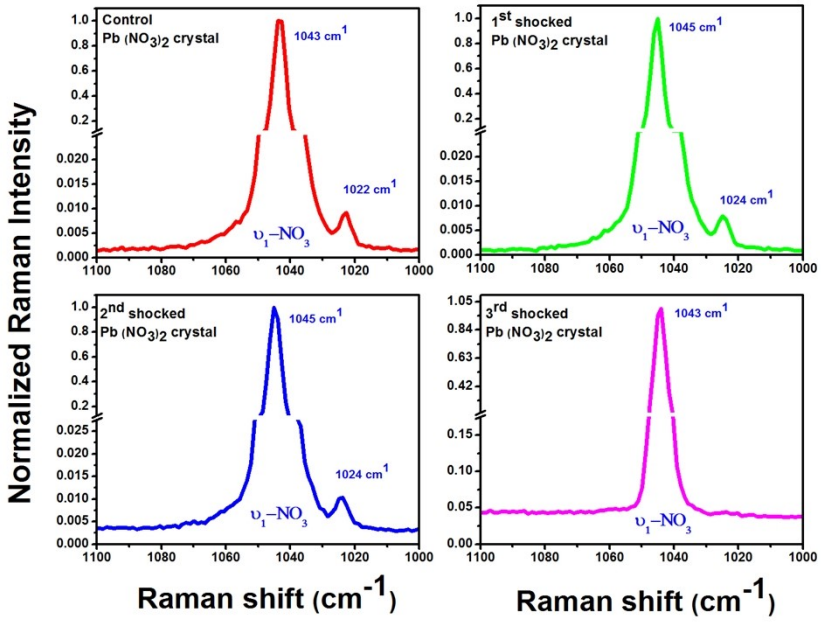

Fig.S4 υ_1-NO_3 Raman spectra of the control and shocked crystals