High-pressure Neutron Diffraction on WAND^{2}in a Paris-Edinburgh Press

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Pressure is a useful tool to increase the reactivity of materials that can aid in and even enable synthesis of novel materials. However, this higher reactivity can also be a hindrance to experiments as samples interact with the apparatus generating the pressure. For example, the diamonds used to generate pressure in one of the most common high pressure cells – the diamond anvil cell – interact with samples at the extremes of pressure. One such system where this phenomenon is a particular hindrance is in high-pressure studies of lithium. Li is often used as a prototype system for the nearly-free electron model. With the application of pressure this simple metal displays a wealth of complex phase behavior as a result of the increased interplay between the core and valence electrons; However, despite decades of theoretical and experimental research dedicated to understanding the complex nature of lithium at high pressure, many conflicting results exist and large regions of pressure-temperature conditions remain unexplored. This is in part due to a lack of high-quality data as a result of lithium's low atomic number, making x-ray diffraction structural investigations difficult. It is however also due to lithium's propensity to break the diamond anvils used in high pressure experiments. The exact mechanism behind this lithium-induced anvil failure at high pressure is unclear and no experimental evidence on the lithium-diamond has been reported. The work presented here will address this short-coming with neutron diffraction data collected on diamond-lithium mixtures pressurized in a Paris-Edinburgh press on WAND^2 at the High Flux Isotope Reactor at Oak Ridge National Laboratory.