Magnetic properties of synthetic taenite at high pressure

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Taenite, an iron-nickel alloy with 20-40 at% nickel, is a major constituent of iron meteorites that have been used to infer planetary core compositions. Many aspects of its magnetic properties are controversial, particularly near the Invar (“invariable”) composition around 36 at% nickel. Open questions include the conditions under which magnetism is lost, so to address this particular controversy, we undertook a combined magnetic remanence and Mössbauer study of synthetic taenite at high pressure. We synthesised polycrystalline iron-nickel alloy with 38 at% nickel, loaded the sample into a diamond anvil cell and collected Mössbauer spectra during decompression from 20 GPa. Our results show a clear loss of magnetism, but at pressures that differ considerably depending on the fitting model. The pressure obtained using the traditional approach involving a magnetic field distribution conflicts with results obtained from other methods, while a simple model based on magnetic field fluctuations gives results that are consistent with other data. Comparison of data from all methods provides insight that can be applied to planetary magnetism.