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An in-situ synchrotron X-ray diffraction analysis of pearlitic steel subjected to shear deformation.

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High-energy synchrotron X-ray diffraction experimental trials were conducted on pearlitic steel samples with carbon content of 0.75 wt.-%. Specimens were submitted to shear deformation and two-dimensional diffraction patterns were acquired during the loading. Lattice strain profiles and evolution of dislocation densities have been analysed in the ferrite and cementite phases. It was revealed that both, the accumulation of lattice strains and the increased intra lamellar dislocation density in the ferrite and cementite contributed to the macroscopic strain hardening of pearlite. Their influence on mechanical properties are discussed.