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Fine structure of the Earth's outermost solid core from PKiKP coda waves

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Ferrous or almost ferrous inner core of the Earth plays an important role in geodynamo theory, mineralogy and studies of condensed matters, whereas seismology is the only source of direct measurements of its properties and structural peculiarities. Although IC is believed to be a result of gradual few billion years long crystallization process, it is rather heterogeneous than a single crystal of iron. The IC fabric is possibly radial diverse, and estimates of sizes of anisotropic hexagonal close-packed (hcp) and face-centered cubic (fcc) iron crystals vary from hundreds of meters to few tens kilometers. We analyze reflections from the Earth's inner core boundary (ICB) and coda waves following the reflections (PKiKP) on array records of underground nuclear explosions. The observed codas after reflections with ray paths diverse in crust, mantle and outer core, and nearby bounce points show similar shape, frequency content, intensity and duration, and feature uncorrelated reflected waveforms as if originating from local discontinuities buried down to 600 km below the ICB, inclined by up to 30 degrees and having acoustic impedance up to 2%. We interpret the observations in terms of misaligned anisotropic iron crystals up to 10 km in size that constitute the upper IC, cause PKiKP coda through scattering and reflections on their boundaries, and contribute to ICB patchiness.