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Polyelectrolyte brushes (PEBs) are functionalizable surface modifiers with tunable response to stimuli. A comprehensive understanding of their conformational behavior can improve already existing applications such as anti-fouling and contribute to their development as smart materials. Our self-consistent field theory (SCFT) considers the coupling of polymer elasticity, solubility, and electrostatic repulsion, enabling the characterization of PEB conformations at various charge fractions and hydrophobicities. Using this theory, we have found that PEBs can be found in multi-layered conformations, in which comprising chains are permitted in only one layer each. Calculated end-point distributions are negligible between layers, as each layer is formed from a melt of chains in entropically favored mushroom conformations. To facilitate the experimental validation of our multi-layered PEB conformations, we show the corresponding reflectivity spectra predicted for up to four-layered PEBs. A good fit with an experimentally measured height profile of a protein brush suggests our model can provide quantitative insights for real-world systems.