We propose a silicon strip waveguide structure with alumina thin-film coating in-between the core and the cladding for group-velocity dispersion tailoring. By carefully designing the core dimension and the coating thickness, a spectrally-flattened near-zero anomalous group-velocity dispersion within the telecom spectral range is obtained, which is predicted to significantly broaden the bandwidth of four-wave mixing. We validate this by characterizing the wavelength conversion in a waveguide sample by atomic layer deposition technology, which to our best knowledge is the first experimental demonstration of the proposed structure. Due to the alumina thin-film coating, the wavelength conversion bandwidth reaches \( \text{<formula><tex>$58 \sim \mathrm{nm}$</tex></formula>} \), an increase by a factor of 1.3 compared to the corresponding structure without coating. This method can also be applied to other material platforms and applications requiring accurate group-velocity dispersion control.