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Effects of Alloying on Optical Properties of Organic-Inorganic Lead Halide Perovskite Thin Films

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The supplementary Information is mainly related to the dielectric function and the fitting of the second derivative of the real and imaginary parts of the dielectric function $d^2\varepsilon/d^2E$ for the methylammonium lead halide alloys, formamidinium lead halide alloys, and lead formadininium cesium alloys, to determine the critical points.

Dielectric functions

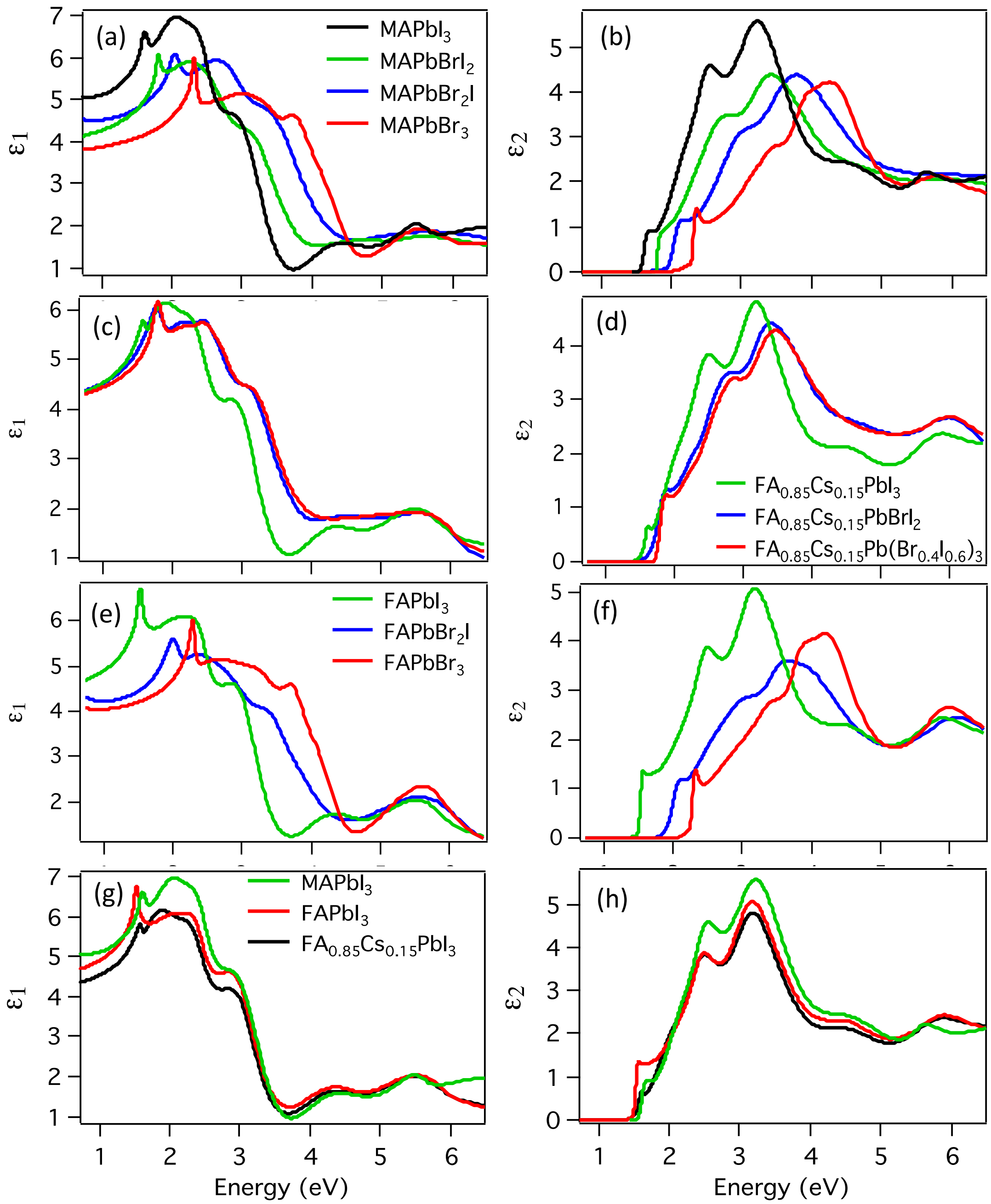

Figure S1. Real and imaginary part of the dielectric function for the methylammonium lead halide alloys (a and b respectively), formamidinium lead halide alloys (c and d respectively), and lead formamidinium cesium alloys (e and f respectively), and comparison between the A cations (g and h respectively).

Absorption coefficient of the perovskite thin films

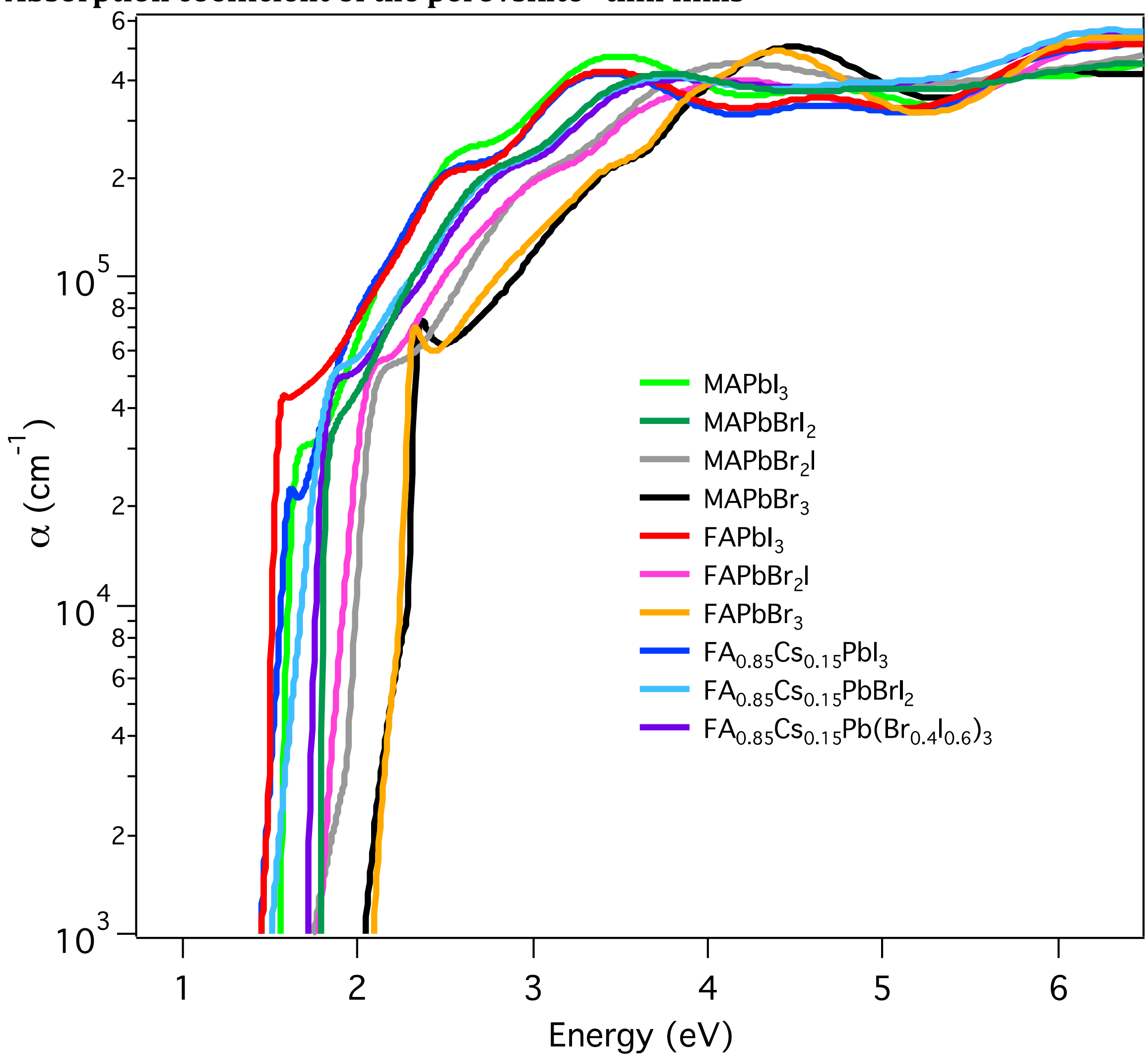

Figure S2. Absorption coefficient (α) spectra of the studied perovskite materials.

Second derivative of the dielectric functions for Methylammonium lead halide alloys

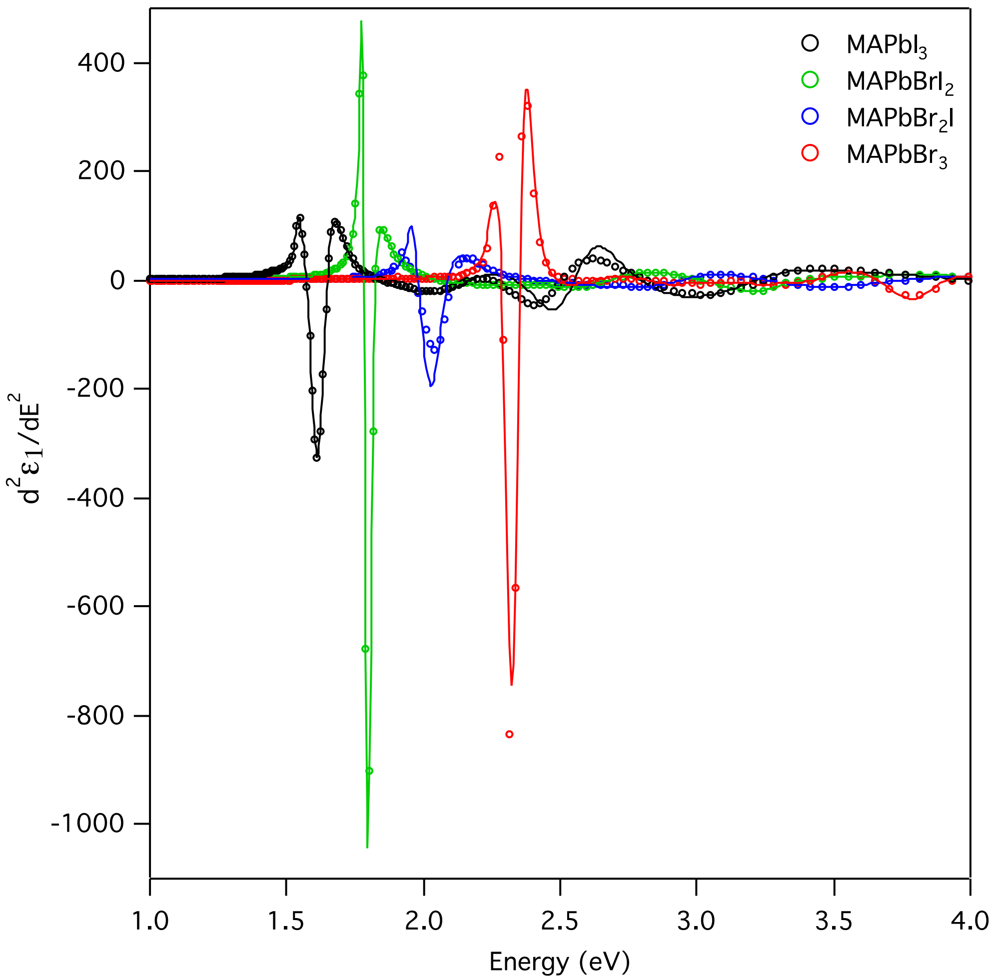

Figure S3. Second derivatives of the real part of the dielectric function for $MAPbI_3$, $MAPbBr_3$, $MAPbBr_2I$, $MAPbBrI_2$ deposited on Si substrates. The open circles denote the experimental data and the solid line represents the theoretical fitting.

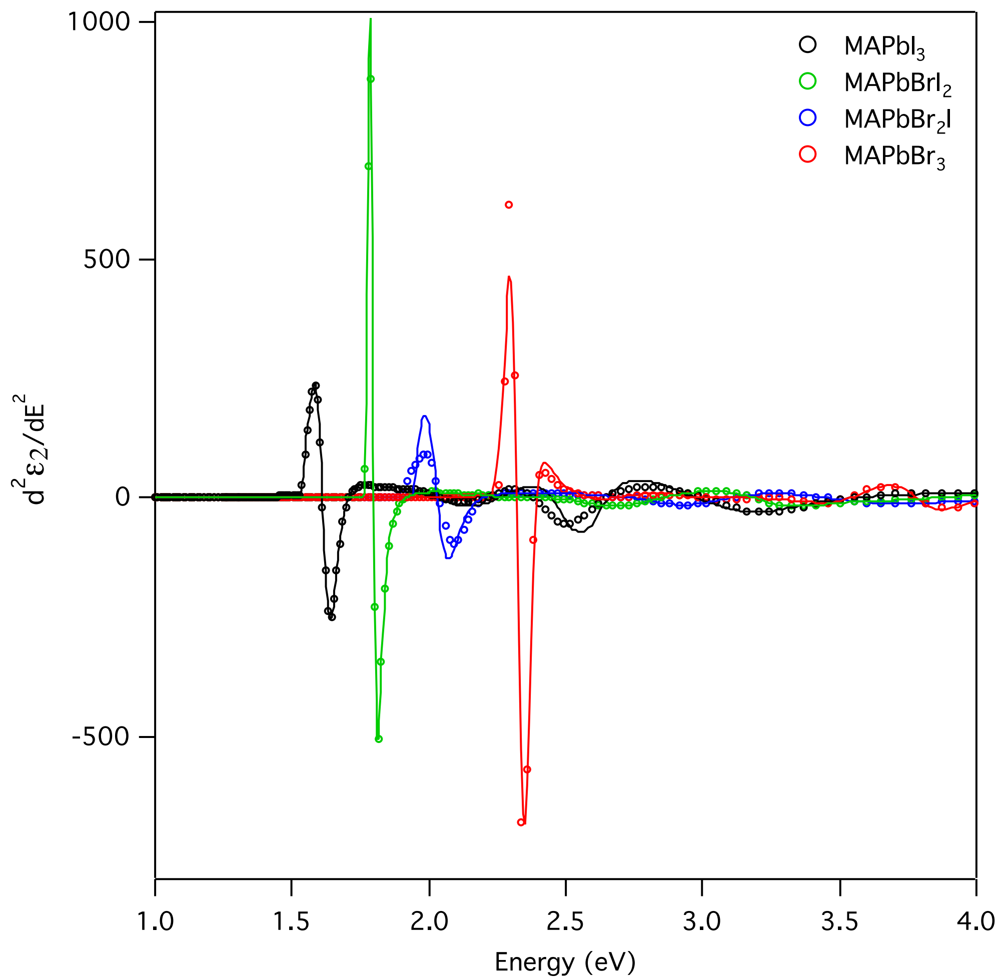

Figure S4. Second derivatives of the imaginary part of the dielectric function for $MAPbI_3$, $MAPbBr_3$, $MAPbBr_2I$, $MAPbBrI_2$ deposited on Si substrates. The open circles denote the experimental data and the solid line represents the theoretical fitting.

Second derivative of the dielectric functions Formamidinium lead halide alloys

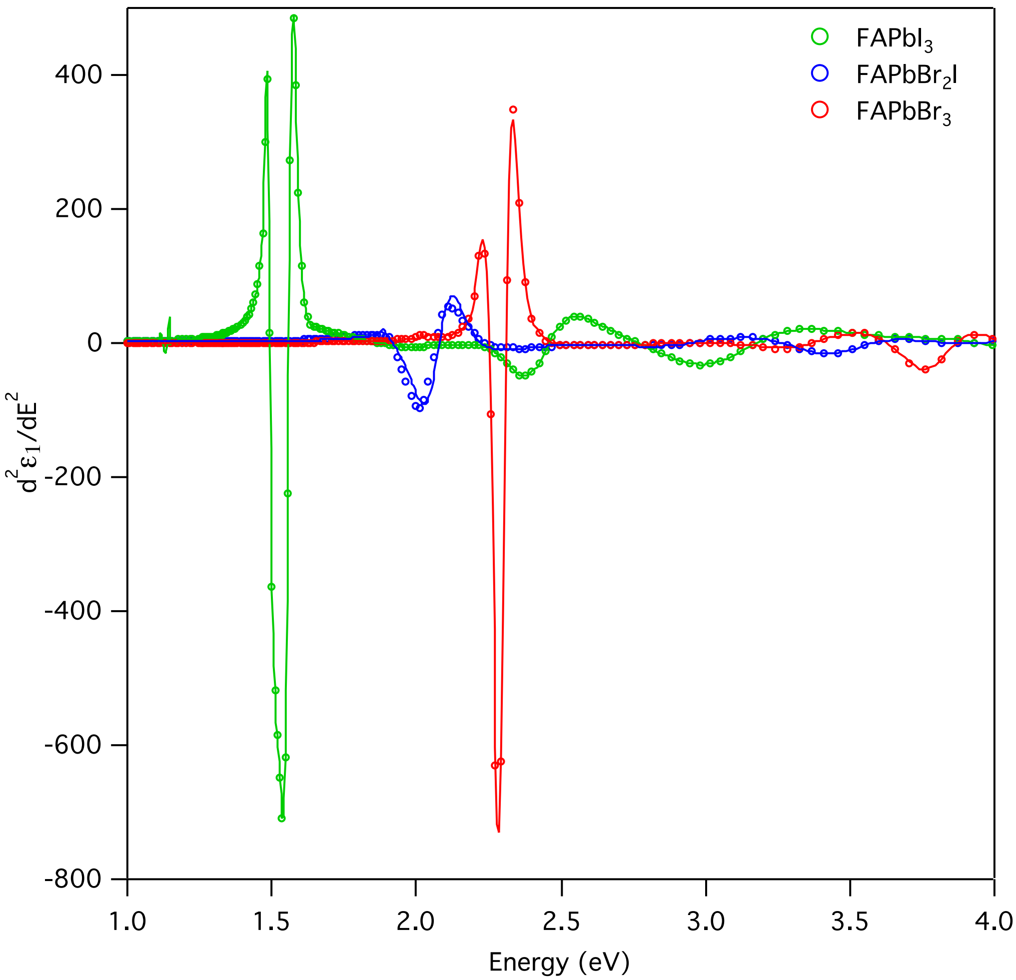

Figure S5. Second derivatives of the real part of the dielectric function for $FAPbI_3$, $FAPbBr_3$, $FAPbBr_2I$ deposited on Si substrates. The open circles denote the experimental data and the solid line represents the theoretical fitting.

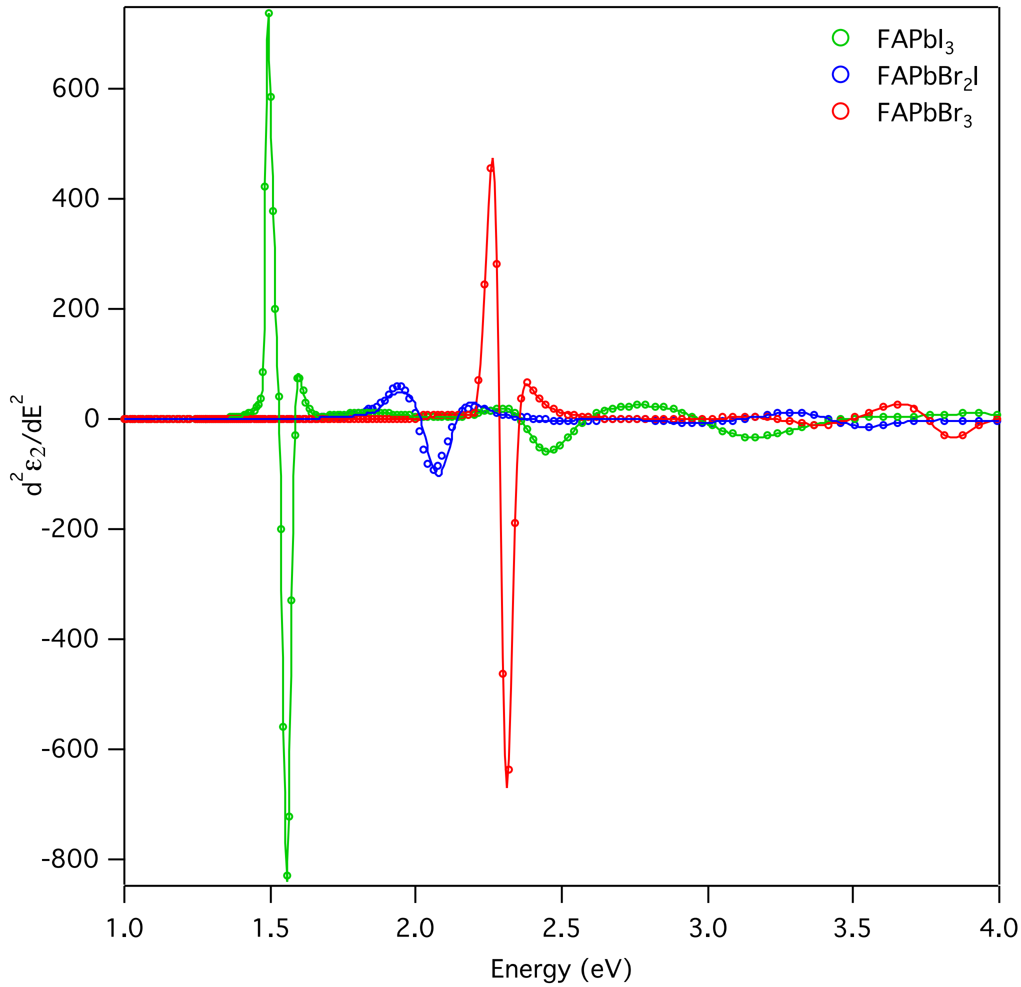

Figure S6. Second derivatives of the imaginary part of the dielectric function for $FAPbI_3$, $FAPbBr_3$, $FAPbBr_2I$ deposited on Si substrates. The open circles denote the experimental data and the solid line represents the theoretical fitting.

Second derivative of the dielectric functions Lead formadininium cesium alloys

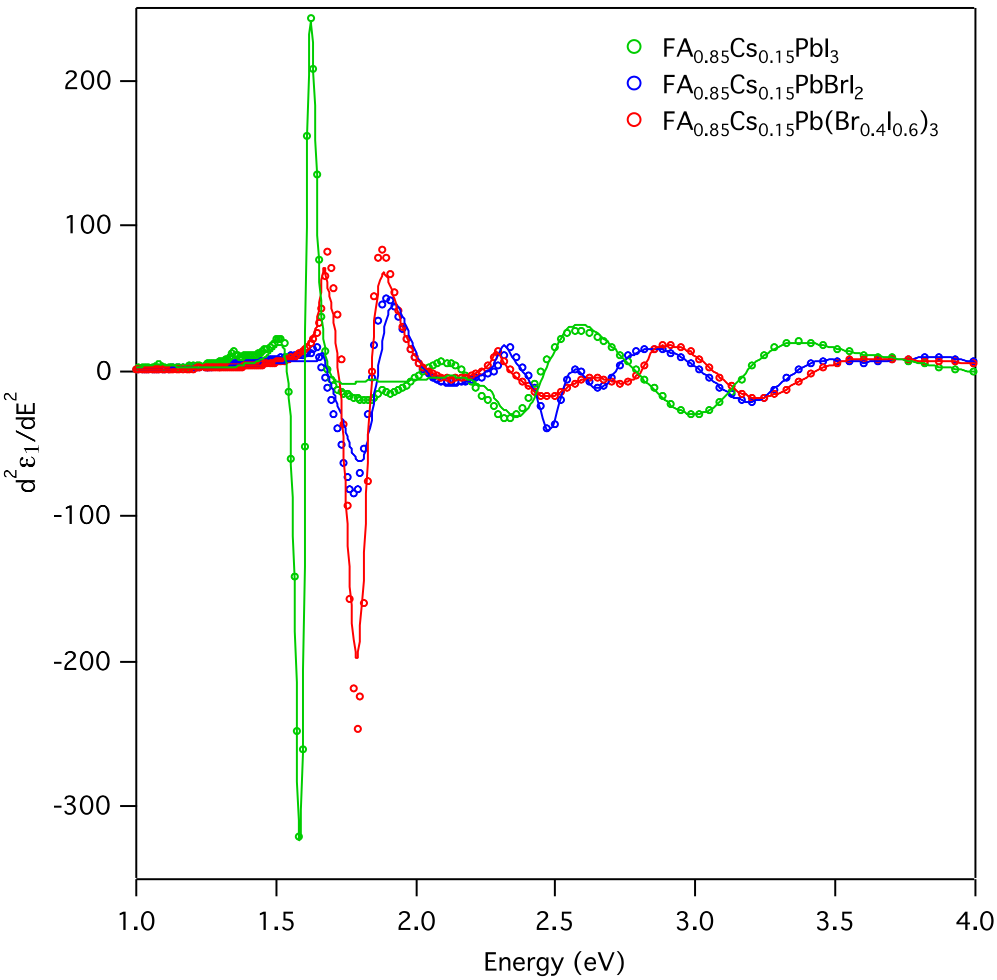

Figure S7. Second derivatives of the real part of the dielectric function for $FA_{0.85}Cs_{0.15}PbI_3$, $FA_{0.85}Cs_{0.15}PbI_2Br$, $FA_{0.85}Cs_{0.15}Pb(Br_{0.4}I_{0.6})_3$ deposited on Si substrates. The open circles denote the experimental data and the solid line represents the theoretical fitting.

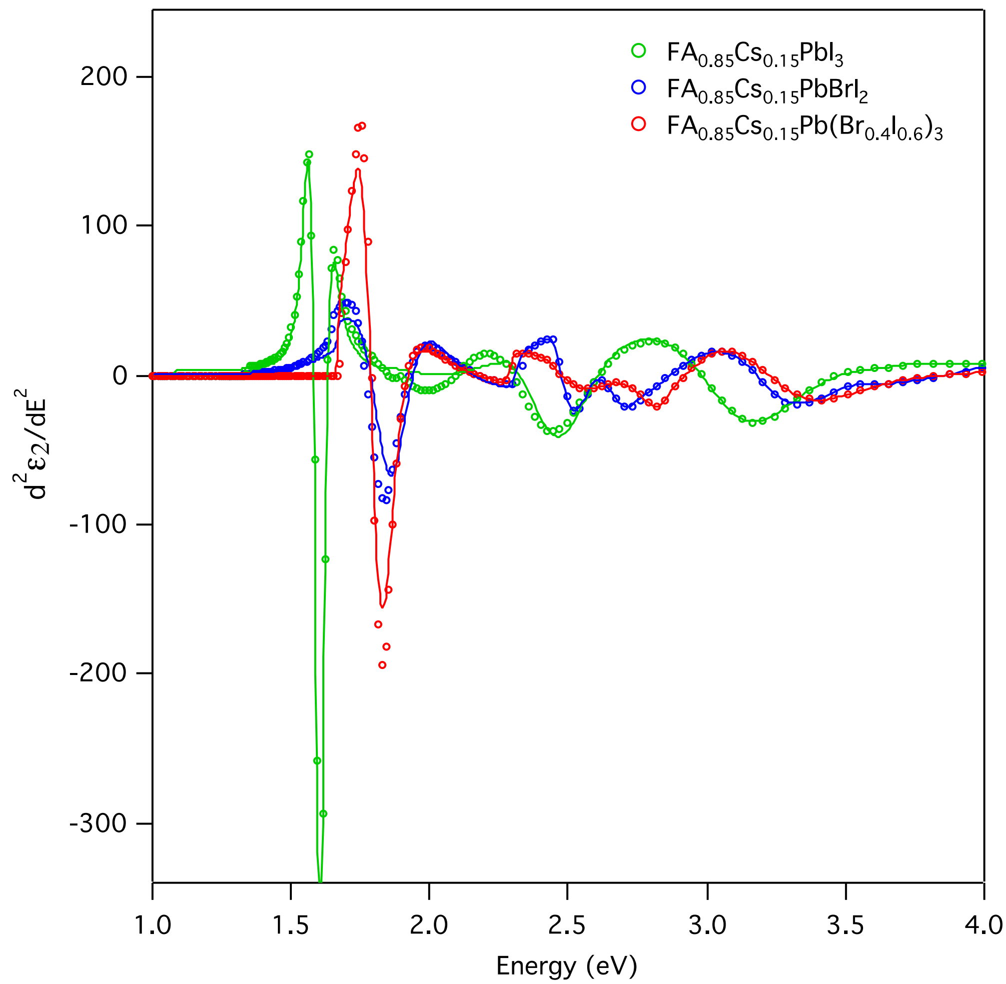

Figure S8. Second derivatives of the imaginary part of the dielectric function for $FA_{0.85}Cs_{0.15}PbI_3$, $FA_{0.85}Cs_{0.15}PbI_2Br$, $FA_{0.85}Cs_{0.15}Pb(Br_{0.4}I_{0.6})_3$ deposited on Si substrates. The open circles denote the experimental data and the solid line represents the theoretical fitting.