**Link:** <https://solar-power-tech.com/e-posters/psc_eposter_05/>

**Abstract**

Three-dimensional (3D) hybrid halide perovskites have emerged as a breakthrough in the field of photovoltaic and optoelectronic devices although their low stability against the environmental agents as heat, humidity and oxygen needs to be addressed if commercial devices are considered to be placed on the market. The incorporation of large organic cations in between “perovskite slabs” to form two-dimensional (2D) hybrid perovskites has been reported to mitigate the degradation against the environmental agents of the three-dimensional (3D) perovskites. The 2D hybrid perovskites, in particular the Ruddlesden-Popper (RP) phase, exhibit excellent optoelectronic properties with a wide flexibility in the type of large organic cations that can be employed. However, the small organic cations inserted in the octahedral voids have been limited so far to those three fulfilling the Goldschmidt tolerance factor (*t*) despite the relaxed structure of the 2D RP perovskites that may open the way to the insertion of other cations.

Here, we present the incorporation of the Gua cation into the octahedral sites of the “perovskite slabs” in 2D RP perovskites. Thus, the methylammonium (MA) cation in the PEA2MA2Pb3I10 perovskite (PEA = phenylethylammonium) has been gradually substituted by the Gua cation to synthesize thin films of the mixed cation PEA2(MA1-xGuax)2Pb3I10 perovskite. X-ray Diffraction (XRD) measurement has revealed a regular expansion of the unit cell when increasing the Gua content up to 90% proving the sequential insertion into the lattice of the Gua. Importantly, the combined analysis of the absorption and photoluminescence (PL) spectra have revealed a change in the distribution of the *n*-members of the 2D RP perovskites towards phases with low n values upon increasing the Gua content. In particular, a sudden change is observed at 30% Gua content which is related to the impossibility of the phases with high *n* values to incorporate more than 25% Gua in their structure. Thus, the addition of a large organic cation that substitutes the small MA cation plays a key role to control the distribution of *n*-members in the 2D RP perovskite films.