CLAIMS

1. A perovskite structure comprising a composition comprising a first organic cation, a second cation, a metal cation and a counter anion, wherein the perovskite structure comprises layers stacked in a stacking direction and polarized charge domains arranged along a horizontal direction which is perpendicular to the layers stacking direction, wherein the first organic cation comprises a linear or branched C_2-C_{10} alkyl substituted with an aryl moiety.

2. The perovskite structure of claim 1, wherein the first organic cation comprises an ammonium functional group, wherein the second cation is a monovalent cation, wherein the metal cation is a divalent metal cation and wherein the counter anion is a monovalent anion.

3. The perovskite structure of claim 2, wherein the composition is of the general formula $((RNH_4)^+_2(A^+)_{\bar{n}-1}M^{2+}_{\bar{n}}X^-_{3\bar{n}+1})$, wherein:
R is a linear or branched ~~, substituted or unsubstituted~~ C_2-C_{10} alkyl substituted with an aryl moiety; ~~linear or branched, substituted or unsubstituted C_2-C_{10} alkenyl; linear or branched, substituted or unsubstituted C_2-C_{10} alkynyl; linear or branched, substituted or unsubstituted C_1-C_{10} alkoxy; substituted or unsubstituted C_3-C_{10} cycloalkyl; substituted or unsubstituted C_3-C_{10} cycloalkenyl; substituted or unsubstituted C_6-C_{10} aryl; substituted or unsubstituted C_3-C_{10} heteroaryl;~~
A^+ is the monovalent cation;
$\bar{n}$ is an integer selected from 2 to ∞;
M^{2+} is the divalent metal cation; and
X^- is the monovalent anion.

4. The perovskite structure of claim 3, comprising octahedral sheets of $[MX_6]^{4-}$ formed from M^{2+} and X^-, wherein the octahedral sheets are perpendicular to the layers of the perovskite structure.

5. The perovskite structure of claim 4, wherein $\bar{n}$ signifies a number of consecutive layers in the octahedral sheets.

6. The perovskite structure of claim 4 or 5, wherein one of the octahedral sheets has a smallest width of at least about 5 Å.

7. The perovskite structure of any of claims 1 to 6, being non-centrosymmetric.

8. The perovskite structure of any of claims 1 to 7, wherein the second cation comprises an ammonium ion.

9. The perovskite structure of any of claims 1 to 7, wherein the second cation is any one selected from a group consisting of a methylammonium ion, a formamidinium ion, a hydroxylammonium ion, a hydrazinium ion, an azetidinium ion, an imidazolium ion, a dimethylammonium ion, an ethylammonium ion, a phenethylammonium ion, a guanidinium ion, a tetramethylammonium ion, a thiazolium ion, a 3-pyrrolinium ion, a tropylium ion, a piperazinium ion, and a dabconium ion.

10. The perovskite structure of any of claims 1 to 9, wherein the second cation is a methylammonium ion.

~~11. The perovskite structure of any of claims 1 to 10, wherein the first organic cation comprises a linear or branched C_2-C_{10} alkyl substituted with an aryl moiety.~~

11~~12~~. The perovskite structure of any of claims 1 to 10~~11~~, wherein the first organic cation comprises a phenylethyl moiety.

12~~13~~. The perovskite structure of any of claims 1 to 11~~12~~, wherein the counter anion is a halide.

13~~14~~. The perovskite structure of claim 12~~13~~, wherein the halide is an iodide, a bromide, a chloride or a mixture thereof.

14~~15~~. The perovskite structure of claim 12~~13~~, wherein the halide is an iodide.

15~~16~~. The perovskite structure of any of claims 1 to 14~~15~~, wherein the metal cation is any metal of group 11, group 14 or group 15 or a mixture of these.

16~~17~~. The perovskite structure of any of claims 1 to 14~~15~~, wherein the metal cation is a heavy metal cation or a mixture of several heavy metal cations.

17~~18~~. The perovskite structure of claim 16~~17~~, wherein the heavy metal cation is lead.

18~~19~~. A process for the production of a perovskite structure comprising polarizable charge domains, the process comprising:
a) forming a perovskite structure from a first organic cation, a second cation, a metal cation and a counter anion on a substrate, wherein the first organic cation comprises a linear or branched C_2-C_{10} alkyl substituted with an aryl moiety; and
b) applying an external electric field through at least one polarizable charge domain of the polarizable charge domains to modify a polarization of the at least one polarizable charge domain.

19~~20~~. The process of claim 18~~19~~, wherein step a) further comprises preparing a precursor solution from the first organic cation, the second cation, the metal cation and the counter anion.

20~~21~~. The process of claim 19~~20~~, wherein step a) further comprises heating the precursor solution to a temperature above room temperature, and depositing the precursor solution on the substrate.

21~~22~~. The process of any of claims 18~~19~~ to 20~~21~~, wherein the external electric field through the at least one polarizable charge domain of the polarizable charge domains is chosen from about 0.1 kV/cm to about 100 kV/cm.

22~~23~~. Use of a perovskite structure comprising a composition comprising a first organic cation, a second cation, a metal cation and a counter anion, wherein the first organic cation comprises a linear or branched C_2-C_{10} alkyl substituted with an aryl moiety, wherein the perovskite structure comprises layers stacked in a stacking direction and wherein the perovskite structure has polarizable charge domains arranged in a

horizontal direction which is perpendicular to the layers stacking direction, as a memory device structure,

wherein a polarization of a domain of the polarizable charge domains represents a unit of information.