CLAIMS

1. A phosphor film comprising:
   an inert substrate;
   a coating comprising micro voids and a quantum dot comprising:
      a core comprising a gradient alloy of at least one metal chalcogenide;
      a shell around the core; and
      the quantum dot being soluble in a polar solvent having a higher vapour pressure than water;
   wherein the micro voids are formed from decomposition of thermally combustible ligands on the shell, such that the inert substrate is without the thermally combustible ligands; and
   a layer of Al_2O_3 conformally deposited on the coating.

2. The phosphor film of claim 1, wherein the gradient alloy has the formula I:
   $Cd_xZn_{1-x}Se_yS_{1-y}$ I
   where values of x and y decrease radially from a centre to a circumference of the core;
   and wherein the shell comprises a layer of ZnS around the core.

3. The phosphor film of claim 1 or 2, wherein thickness of the shell ranges from 0.3nm to 1.5nm.

4. The phosphor film of any preceding claim, wherein the thermally combustible ligands comprise tetramethylammonium hydroxide (TMAH) bound to 3-mercaptopropionic acid (3-MPA).

5. The phosphor film of any preceding claim, wherein the polar solvent is ethanol.

6. A method of forming a phosphor film of any preceding claim, the method comprising the steps of:
   (a) coating the inert substrate with the quantum dots via solution processing techniques using a solution of the quantum dots in a polar solvent having a higher

vapour pressure than water; and

(b) performing atomic layer deposition of Al_2O_3 on the coating.

7. The method of claim 6, wherein in step (b), the thermally combustible ligands are decomposed to form the micro voids in the coating.

8. The method of claim 6 or 7, wherein the quantum dots are formed from a method comprising the steps of:

adding 3-MPA to a solution of a preliminary quantum dot having native ligands in an organic solvent to obtain a first suspension;

centrifuging the first suspension to obtain the preliminary quantum dot having surface bound 3-MPA ligands in solid form;

adding a polar solvent to the preliminary quantum dot having surface bound 3-MPA ligands to form a second suspension;

adding TMAH to the second suspension to form a solution of the quantum dot having thermally combustible ligands in the polar solvent;

adding a non-polar solvent to the solution obtained in step (d) to obtain a third suspension; and

centrifuging the third suspension to obtain the quantum dot having thermally combustible ligands in solid form.

9. The method of claim 8, further comprising dissolving the quantum dot having thermally combustible ligands in solid form in a polar solvent having a higher vapour pressure than water.

10. The method of claim 9, wherein the polar solvent is ethanol.