Claims

1. A nanocomposite coating comprising:
   - a 2-dimensional material; and
   - a polymer,

wherein the 2-dimensional material is treated with sodium bisulfate, and wherein the nanocomposite coating is semi-permeable and is provided on a porous ceramic material to improve selectivity towards one phase over others thereby enabling separation of that phase by mass transfer.

2. The nanocomposite coating according to claim 1, wherein the 2-dimensional material is a graphene-based material, boron nitride-based material or transition metal dichalcogenide, or a combination thereof.

3. The nanocomposite coating according to claim 1 or 2, wherein the 2-dimensional material is: graphene oxide (GO), hexagonal boron nitride (h-BN), molybdenum disulphide (MoS_2), or a combination thereof.

4. The nanocomposite coating according to any preceding claim, wherein the polymer is: polyvinyl alcohol (PVA), chitosan, polyvinylpyrrolidone (PVP), cellulose, agarose, or co-polymers thereof.

5. The nanocomposite coating according to any preceding claim, wherein the nanocomposite coating has a viscosity in a range of 100-10000 cps.

6. The nanocomposite coating according to claim 1, wherein the ceramic material is: SiC, zeolite, clay, gypsum, hydroxyapatite, alumina, or a combination thereof.

7. A phase transformation and mass transfer unit comprising the nanocomposite coating according to any preceding claim.

8. The phase transformation and mass transfer unit according to claim 7, wherein the phase transformation and mass transfer unit is comprised in a separation unit of a liquid phase separation system.

9. A low temperature liquid phase separation method, the method comprising:

- providing a dragging gas stream;
- flowing a liquid mixture through a phase transformation and mass transfer unit according to claim 7 or 8 to enable phase transformation and mass transfer of vapour phase; and
- channelling the dragging gas stream through the phase transformation and mass transfer unit, the dragging gas stream being channelled to the phase transformation and mass transfer unit,

wherein the vapour phase separates from the liquid mixture and becomes incorporated in the dragging gas stream.

10. The method according to claim 9, wherein the method is carried out at a temperature of 20-40°C.

11. The method according to claim 9 or 10, wherein the dragging gas stream comprises: nitrogen, hydrogen, inert gas, air, or a mixture thereof.