

Claims

1. A separation apparatus, comprising:
 - a layerizer arranged to bring a group of particles in a layer on a transport surface with a constant spatial relation of the particles relative to each other in the layer;
 - 5 - an identifier arranged to identify particles in the group of particles that have a specific property;
 - a separator arranged to separate the particles in the group based on a difference in affinity between the particles and the separator;
 - an affinity modifier arranged to modify said affinity for
 - 10 identified particles relative to non-identified particles in the group; wherein
 - the layerizer comprises a recirculating transport surface on which the particles of the layer are carried along a transport trajectory, wherein
 - the transport surface is arranged as a rigid plane so as to limit
 - 15 movement of the particles transverse to the transport trajectory.
2. The separation apparatus of claim 1, wherein the transport surface is arranged to rotate.
3. The separation apparatus of claim 2, wherein the transport surface is a mantle surface, in particular a rotating mantle surface of a
- 20 drum.
4. The separation apparatus according to any of claims 1-3, wherein the transport trajectory includes a particle delivery zone where the particles disengage the transport surface to become airborne and travel along a flight path to the separator.
- 25 5. The separation apparatus according to claim 4, wherein the particle delivery zone includes a part of the transport trajectory where the transport surface moves downward.

6. The separation apparatus according to any of claims 1-5, wherein the transport trajectory includes a particle pickup zone where the particles engage the transport surface.
7. The separation apparatus according to claim 6, wherein the
5 particle pickup zone includes a part of the transport trajectory where the inside of the mantle surface passes along a zone where air pressure is arranged to be lower than at the outside of the transport surface, and where particles are sucked onto the transport surface by ambient air passing through apertures in the transport surface.
- 10 8. The separation apparatus according to any of the preceding claims, wherein the layerizer comprises a fluidized bed of particles that is maintained along a part of the transport trajectory, in particular at the pickup zone according to claims 6 or 7.
9. The separation apparatus according to any of the preceding
15 claims, wherein the transport surface is provided with a plurality of apertures for passing air therethrough.
10. The separation apparatus according to any of the preceding claims, wherein the transport surface is a mantle surface that is arranged to rotate about a stationary support core of a drum.
- 20 11. The separation apparatus according to any of the preceding claims, wherein the transport trajectory includes an identification zone where the transport trajectory extends along the identifier.
12. The separation apparatus according to any of the preceding claims, wherein the separator comprises a catch surface on which identified
25 particles in are caught, preferably a recirculating catch surface.
13. The separation apparatus according to claim 12, wherein the catch surface is a mantle surface that is arranged to rotate as a rigid plane.
14. The separation apparatus according to any of the preceding claims, wherein the affinity modifier modifies the affinity of the identified
30 particles for the catch surface by applying affinity modifying particles to the

identified particles, in particular to increase the affinity between the identified particles and the catch surface.

15. The separation apparatus according to any of the claims 1-14, wherein the affinity modifier modifies the affinity of the catch surface for the identified particles by applying affinity modifying particles to the catch surface of the separator, in particular corresponding to that particles' position in the layer on the transport surface.

16. The separation apparatus according to claim 14 or 15, wherein the affinity modifying particles form a layer onto the identified particles or the catch surface.

17. The separation apparatus according to any of claims 14-16, wherein the affinity modifying particles include or are liquid droplets.

18. The separation apparatus according to claim 17, wherein the liquid droplets comprise water to form a moisture bridge between the identified particles and the separator.

19. The separation apparatus according to any one of the preceding claims, wherein the affinity modifier comprises a printer head.

20. The separation apparatus according to any one of the preceding claims, wherein the particles are plastic flakes

21. The separation apparatus according to any of the preceding claims, wherein the specific property is a type of material, color, shape and/or size.

22. Apparatus according to any one of the preceding claims, wherein the group of particles comprises small particles with dimensions in the range between 0.2 mm and 30 mm.

23. Method for separation of particles from a group of particles, comprising the steps of:

- providing a group of particles that comprises particles with different properties, e.g. material, color, shape and/or size;

- supplying the group of particles to a transport surface that moves along a transport trajectory as a rigid plane so as to bring the group of particles in a layer with a constant spatial relation on the transport surface;
 - identifying particles in the group of particles that have a specific
5 property;
 - modifying an affinity between the identified particles and a separator relative to that affinity between non-identified particles and the separator using an affinity modifier;
 - separating the particles in the group based on their difference in
10 the affinity with the separator.
24. The method according to claim 23, further including
- casting the particles off the transport surface to become airborne and travel along a flight path to a catch surface of the separator.
25. The method according to claim 24, further including
- modifying the affinity of the identified particles by applying
15 affinity modifying particles to the identified particles and/or the catch surface to increase the affinity between the identified particles and the catch surface.
26. A method for bringing a group of particles (4) in a layer, wherein the method comprises for each one particle of the group of particles
20 (4):
- accelerating the one particle along a particle transport path (50), thereby spacing the one particle apart from at least one other particle of the group of particles (4);
 - receiving the one particle on a particle receiving surface (51) which
25 extends along the particle transport path (50), thereby contributing the one particle to a layer of particles of the group of particles (4) which layer is thereby formed on the particle receiving surface (51); and
 - decelerating the accelerated one particle on the particle receiving surface (51) along the particle transport path (50), thereby reducing a
30 distance along the particle receiving surface (51) between the one particle and at least one neighboring particle of the formed layer of particles.

27. The method according to claim 26, wherein the accelerated one particle is decelerated by friction between the one particle and the particle receiving surface (51).

28 The method according to any of claims 26-27, wherein the one
5 particle is accelerated along the particle transport path by a force of gravity acting on said one particle.

29. The method according to any of claims 26-28, wherein a flow of fluid, e.g. air, is provided along the particle transport path, wherein the one particle is accelerated along the particle transport path by said flow of fluid.

10 30. The method according to any of claims 26-29, wherein at least one, preferably each, particle of the group of particles (4) is accelerated and/or decelerated at a different time and/or at a different rate and/or from a spaced apart position compared to at least one, preferably each, other particle of the group of particles (4).

15 31. The method according to any of claims 26-30, wherein the one particle is accelerated along the particle transport path (50) to a respective increased particle velocity along the particle transport path (50), wherein said increased particle velocity exceeds a velocity of the particle receiving surface (51) along the particle transport path (50),

20 wherein the accelerated one particle is decelerated along the particle transport path (50) to a reduced particle velocity along the particle transport path (50), wherein said reduced particle velocity is equal to or exceeds said velocity of the particle receiving surface (51), wherein said reduced particle velocity is less than said increased particle velocity.

25 32. The method according to any of claims 26-31, wherein each particle is accelerated such that overlap of particles along the particle transport path is reduced, wherein each accelerated particle is decelerated such that sparsity of the formed layer of particles is reduced,

30 wherein preferably each accelerated particle is decelerated such that the formed layer is a layer with a substantially constant spatial relation of the particles relative to each other in the layer.

33. The method according to any of claims 26-32, wherein the method further comprises:

- passing the layer of particles from the particle receiving surface (51) to a downstream conveyor (54) and conveying the layer on the downstream conveyor (54) further along the particle transport path (50) at a predetermined conveyor velocity which is defined relative to a rate at which the layer is passed to the downstream conveyor, thereby adjusting at least one of a particle overlap and a particle sparsity of the layer.

34. The method according to any of claims 26-33, further comprising:

- subjecting, in particular upon the receiving, the received one particle to a reception force, for example a centrifugal force, which has a substantially non-zero component perpendicular to and towards the particle receiving surface (51),

wherein said reception force is preferably larger than a force of gravity acting on said one particle, more preferably at least double said force of gravity, more preferably at least five times said force of gravity, more preferably at least ten times said force of gravity, for example about twenty times said force of gravity.

35. A layering apparatus (52) for bringing a group of particles (4) in a layer, wherein the layering apparatus (52) comprises:

- a particle accelerator (53) for accelerating particles of the group of particles (4) along a particle transport path (50); and
- a particle receiving surface (51) extending along the particle transport path (50) for receiving particles of the group of particles (4) and for decelerating received accelerated particles along the particle transport path (50), preferably downstream of the particle accelerator (53),

wherein the layering apparatus (52) is configured to form a layer of particles of the group of particles (4) on the particle receiving surface (51).

36. The layering apparatus according to claim 35, wherein the particle receiving surface (51) is configured to decelerate received accelerated

particles by friction between the particle receiving surface (51) and the received particles,

wherein preferably at least one of a surface roughness, a material property, a shape and an orientation of the particle receiving surface (51) is
5 configured to promote friction between the particle receiving surface (51) and the received particles.

37. The layering apparatus according to any of claims 35-36, wherein the particle accelerator (53) is configured to accelerate particles of the group of particles (4) by allowing said particles to be accelerated by a force of
10 gravity acting on said particles, wherein, at the particle accelerator (53), the particle transport path (50) extends in an at least partially downward direction.

38. The layering apparatus according to any of claims 35-37, wherein the particle accelerator (53) is configured to provide a flow of fluid, e.g. air,
15 along the particle transport path such that particles of the group of particles (4) are accelerated by said flow of fluid.

39. The layering apparatus according to any of claims 35-38, further comprising a downstream conveyor (54) configured to receive the layer of particles, in particular from the particle receiving surface (51), and for
20 conveying the layer of particles further along the particle transport path (50) at a predetermined conveyor velocity which is defined relative to a rate at which the layer is passed to the downstream conveyor such that at least one of a particle overlap and a particle sparsity of the layer is adjustable by the downstream conveyor (54).

25 40. The layering apparatus according to any of claims 35-39, wherein the particle receiving surface (51) includes a curved section (51) along a respective curved section of the particle transport path (50),

wherein the layering apparatus, in particular the particle accelerator and the curved section, is configured to subject particles received
30 on the particle receiving surface (51) to a centrifugal force which has a substantially non-zero component perpendicular to and towards the particle

- receiving surface (51), wherein said centrifugal force is preferably larger than a force of gravity acting on a respective particle, more preferably at least double said force of gravity, more preferably at least five times said force of gravity, more preferably at least ten times said force of gravity, for example about twenty times said force of gravity.
41. A separation apparatus, comprising
- a layering apparatus (52) according to any of claims 35-40 for bringing a group of particles (4) in a layer;
 - an identifier arranged to identify particles in the group of particles that have a specific property;
 - a separator arranged to separate the particles in the group based on a difference in affinity between the particles and the separator; and
 - an affinity modifier arranged to modify said affinity for identified particles relative to non-identified particles in the group.
42. Method for separation of particles from a group of particles, the method comprising:
- providing a group of particles that comprises particles with different properties, e.g. material, color, shape and/or size;
 - bringing, according to any of claims 26-34, the group of particles (4) in a layer;
 - identifying particles in the group of particles that have a specific property;
 - modifying an affinity between the identified particles and a separator relative to that affinity between non-identified particles and the separator using an affinity modifier; and
 - separating the particles in the group based on their difference in the affinity with the separator.