LICENSING OPPORTUNITY

ETH transfer – Linking Science and Business

Enhanced surface modification of pharmaceutical powders at atmospheric pressure

Keywords

Micro-particle processing, surface functionalization, low temperature plasma, wettability improvement, afterglow treatment, fluidization, polymer, chemistry

Background

In recent years, low pressure plasma processes experienced rapid development for the modification of solid particles without changing their bulk properties. As example, polymer powders were modified to become more wettable and the flowability of pharmaceutical agents could be enhanced in tens of milliseconds compared to hours by conventional methods. However, severe drawbacks as the need for vacuum systems or strong reactor clogging limit its implementation in industry.

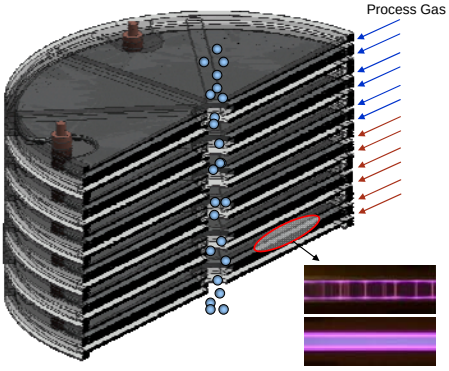

Figure 1: Reactor concept for particle treatment in the afterglow of atmospheric plasma. Typical dimension of a basic discharge unit: $d_{TreatmentZone}$ = 10 mm, $d_{overall}$ = 85 mm, h = 22 - 30 mm, for large reactors the discharge units can be multiplied. (The plasma images are kindly provided by Sublet).

Patent Status

- Patent pending PCT/EP2008/067775

Invention

The presented invention relates to a novel technology that allows treating surfaces of most particulates, temperature sensitive materials by a remote plasma process at atmospheric pressure. This avoids the drawbacks of expensive vacuum systems, semi-batch operation, product heating and depositions. This continuous and scalable process is based on the spatial separation of the plasma creation zone from where the sensitive particles are treated. The process gas is excited in the plasma zone and then transported to the particle surface where surface functionalities are introduced (Fig. 1, afterglow treatment).
These functionalities are strongly depending on the process gas being introduced. In case of oxygen containing components, the surface becomes hydrophilic i.e. enhanced water wettable. In polymer industry, considerable amounts of tensides and environmentally polluting solvents can thus be replaced.
By further developing this technology, it might even be possible to generate nanoparticles directly in the gas phase, which are then attached to any particulate material. In that case, new promising applications in powder technology such as the improvement of the bulk flowability or coatings with catalytic active surfaces are feasible. Poor flow behavior impacts on manufacturing efficiency, regarding equipment clogging and lower production rates.

Features & Benefits

- Gentle treatment of sensitive powders
- Very short processing times (msec)
- Cost effective (no vacuum)
- Scalable process
- Integration into existing systems based on continuous processing
- Plasma process at atmospheric pressure and ambient temperature

Field of Application

Pharmaceutical and Chemical industries:

- Improved flow behavior of powders
- Precise dosing possible (e.g. tabletting)
- Controlled process

Polymer industries:

- Wettable and non-wettable surfaces
- Replacement of tensides and harmful solvents
- Paste dot coatings in textile interlining
- Bonding of paper to aluminum
- Fillers for fiber-reinforced composite materials

References

- Reichen P. et al, Plasma Process. Polym., 2009, *6*, DOI: 10.1002/ppap.200930904
- Remote non-thermal atmospheric plasma treatment of temperature sensitive materials and apparatus therefore, Patent pending PCT/EP08/67775

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