METHOD OF MAKING A MULTILAYER ARTICLE

The present invention relates to a method of making a multilayer article.

Multilayer articles are known in the art and used in a number of fields such as the pharmaceutical, detergent, ceramics and explosives industries. Depending on their intended use, known multilayer articles may comprise a plurality of layers having different compositions, different physical properties or a combination thereof.

Multilayer articles may be formed from particulate materials by pressing or extrusion. Typically, pressing is used to form multilayer articles comprising a plurality of transverse layers In such multilayer articles, the plurality of transverse layers meet one another along parallel interfaces that extend across the width of the multilayer article.

Typically, extrusion is used to form multilayer articles having a plurality of longitudinal layers. In such multilayer articles, the plurality of longitudinal layers meet one another along parallel interfaces that extend along the length of the multilayer article.

It would be desirable to provide a method of making multilayer articles that comprise a mixture of transverse layers and longitudinal layers from particulate materials.

According to the invention there is provided a method of making a free-standing, self-supporting multilayer article. The method comprises: providing a mould defining a first mould cavity, wherein the mould comprises a removable element within the first mould cavity; placing a first particulate component in the first mould cavity; compressing the first particulate component along a first axis in a first compression step to form a first layer of the free-standing, self-supporting multilayer article by applying a first compression force to the first particulate component; removing the removable element from the first mould cavity after formation of the first layer; placing one or more additional particulate components in the mould wherein a portion of the one or more additional particulate components occupies a space formerly occupied by the removable element; compressing the one or more additional particulate components along the first axis in one or more additional compression steps after removal of the removable element to form one or more additional layers of the free-standing, self-supporting multilayer article, wherein the first layer meets one of the one or more additional layers along a first interface substantially parallel to the first axis and the first layer meets one of the one or more additional layers along a second interface substantially perpendicular to the first axis; and removing the free-standing, self-supporting multilayer article from the mould. The one or more additional compression steps comprise applying a compression force to the one or more additional particulate components prior to removing the free-standing, self-supporting multilayer article from the mould that is greater than the first compression force applied to the first particulate component to form the first layer.

As used herein, the term 'particulate component' is used to describe any flowable particulate material or combination of particulate materials including, but not limited to, powders and granules. Particulate components used in methods according to the invention may

comprise two or more particulate materials of different types. Alternatively or in addition, particulate components used in methods according to the invention may comprise two or more particulate materials of different composition.

As used herein, the term 'different composition' is used to refer to materials, components or layers formed from different compounds, or from a different combination of compounds, or from a different formulation of the same combination of compounds.

As used herein, the terms 'layer' and 'layers' are used to refer to distinct portions of multilayer articles made by methods according to the invention that meet one another along interfaces. Use of the terms 'layer' and 'layers' is not limited to distinct portions of multilayer articles made by methods according to the invention having any particular absolute or relative dimensions. In particular, layers of multilayer articles made by methods according to the invention may be laminar or non-laminar.

Different layers of multilayer articles made by methods according to the invention may have the same or different compositions. Alternatively or in addition, different layers of multilayer articles made by methods according to the invention may have the same or different physical properties. For example, different layers of multilayer articles made by methods according to the invention may have different densities.

Different layers of multilayer articles made by methods according to the invention may have the same or different dimensions.

In accordance with the invention, the first layer of the multilayer article is formed by compressing the first particulate component in a first compression step and the one or more additional layers of the multilayer article are formed by compressing one or more additional particulate components in one or more subsequent compression steps.

The first compression step comprises applying a first compression force to the first particulate component. The one or more additional compression steps comprise applying a compression force to the one or more additional particulate components prior to removing the multilayer article from the mould that is greater than the first compression force applied to the first particulate component.

The methods of the invention ~~may advantageously be~~are used to make free-standing, self-supporting multilayer articles. Applying a compression force to the one or more additional particulate components prior to removing the multilayer article from the mould that is greater than the first compression force applied to the first particulate component to form the first layer advantageously facilitates the manufacture of free-standing, self-supporting multilayer articles using methods according to the invention.

As described in more detail below, by removing the removable element from the first mould cavity between the first compression step used to form the first layer and the one or more subsequent compression steps used to form the one or more additional layers, the method of