Object of the Invention

It is an object of the present invention to substantially overcome or at least ameliorate one or more of the above disadvantages. It is a further object to at least partially satisfy the above need.

Summary ~~of the Invention~~

The present disclosure~~In a first aspect of the invention there is~~ provideds a process for making a epoxy composite comprising combining an epoxy prepolymer, a curing agent and a particulate filler to form a curable mixture, agitating the mixture to render it substantially homogeneous and applying pressure to the mixture to reduce or eliminate gas pockets in the mixture. In the present context, the term "reduce" refers to a reduction in size (e.g. volume) of the gas pockets. The pressure should be maintained until the curable mixture is cured to form the epoxy composite. The step of agitating, and optionally also of combining, may be conducted under a non-air atmosphere.

In a first aspect, there is provided a process for making a epoxy composite comprising:

- combining an epoxy prepolymer, a curing agent and a particulate filler to form a curable mixture;
- agitating the mixture under a non-air atmosphere to render it substantially homogeneous;
- applying pressure to the mixture to reduce or eliminate gas pockets in the mixture; and
- maintaining the pressure until the curable mixture is cured to form the epoxy composite.

The following options may be used in conjunction with the first aspect, either individually or in any suitable combination.

The pressure applied to the mixture may be at least about 7000kPa, or may be about 7000 to about 15000kPa. It may alternatively be about 2000 to about 7000kPa. The lower pressures may be used to make composites for use at lower pressures than those made using higher pressures. The pressure may be applied isostatically. It may be applied hydrostatically. The prepolymer and the curing agent may be such that the working time of the curable mixture at 20°C is at least about 1 hour, or at least about 6 hours, or at least about 1 day. They may be such that the curable mixture does not cure at about 20°C, or such that it does not cure at about 20°C for at least about 1 day or at least about 1 week.

The combining may be accompanied by, or preceded by, cooling of one or more of the components of the curable mixture. It may for example comprise cooling the

prepolymer and then adding the curing agent and particulate filler. The cooling may be to a temperature of about 0 to about 10°C, e.g. to about 3°C.

The non-air atmosphere under which the agitating, and optionally also the combining, is conducted may be one which has a solubility in the curable mixture which is higher than the solubility of air in the curable mixture at the same temperature. The non-air atmosphere may comprise at least about 50% argon on a molar basis. It may be welding gas. It may comprise about 93% argon and about 5% carbon dioxide. It may comprise about 2% oxygen. It may comprise about 93% argon and about 7% carbon dioxide.

The present disclosure~~In a second aspect of the invention there is~~ provideds an epoxy composite comprising a particulate filler and having an ultimate stress under compression of greater than or equal to 100MPa. The composite may have a density of less than about 0.7 g/cc.

In a second aspect, there is provided an epoxy composite comprising a particulate filler and having an ultimate stress under compression of greater than or equal to 100MPa and a density of less than about 0.7 g/cc.

The following options may be used in conjunction with the second aspect, either individually or in any suitable combination.

The epoxy composite may be made by the process of the first option.

The epoxy composite may be a syntactic foam.

The epoxy composite may have a compressive modulus such that strain under compression of 110MPa is less than or equal to about 0.9%. It may exhibit linear distortion of less than or equal to about 0.9% under hydrostatic compression pressure of 110MPa.

It may have a low water absorption. It may have an equilibrium water absorption of less than about 0.5% w/w, or less than about 0.1% w/w.

The density of the particulate filler may be less than about 0.5 g/cc. The particulate filler may be, or may comprise, hollow microspheres. The hollow microspheres may be hollow glass microspheres. The particulate filler may be present in the composite at about 60% or more by volume.

The epoxy composite may additionally comprise a second filler. The second filler may be a fibrous filler. The second filler may comprise aramid fibres and/or e-glass fibres. The fibres may be about 0.2 to about 2mm in mean length. The second filler may be present in the composite at about 0.1 to about 1% w/w. The epoxy composite may in some cases comprise one or more further fillers.

The epoxy composite of the second aspect may be made by the process of the first aspect.

In an embodiment there is provided an epoxy composite comprising a particulate filler composed of hollow glass microspheres, said composite:

- having an ultimate stress under compression of greater than or equal to 100MPa,
- exhibiting linear distortion of less than or equal to about 0.9% under hydrostatic compression pressure of 110MPa; and
- having a density of less than about 0.7 g/cc.

The present disclosure~~In a third aspect of the invention there is~~ provideds use of an epoxy composite according to the second aspect, or made by the process of the first aspect, as a structural component under compression.

In a third aspect, there is provided use of an epoxy composite as disclosed herein as a structural component under compression.