



Summary:

The invention consists of a method of forming polymer pre-forms that allows to combine the advantages of compression molding and vacuum bagging techniques to obtain complex geometries with adapted mechanical characteristics.

Benefits:

Manufacturing of "near net shape" ceramic matrix composites characterized by complex shapes.

Method for making a fiber-reinforced composite component

Problem Addressed:

Hot structures based on CMC materials are characterized by complex geometries. These structures are made by means of a pre-form of composite material with resins characterized by high carbon yield and subsequently pyrolyzed and infiltrated with different techniques (CVI, PIP, LSI). The forming of the structure in the polymer phase is an extremely critical process that must combine geometric complexity with the correct compaction of the fibers in order to obtain the required mechanical characteristics of the product.

Proposed use:

Manufacturing of complex structural parts of space systems and aircraft (turbine blades, aircraft wings or flaps, thermal protection systems in general, pistons for engines, etc.) using long-fiber reinforced composite materials. In addition, there are potential opportunities for exploitation in the automotive sector in the field of racing and luxury cars (braking systems).

Technology overview:

The forming phase of materials with continuous fibers can be carried out by vacuum bagging; resin transfer moulding; vacuum infusion; or compression moulding. The patent exploits innovative methods for forming by hand lay-up and vacuum bagging of pre-consolidated parts using different forming methods, in order to obtain the required mechanical properties.

Reference Project:

The technology was developed within the framework of the ProRa SHS project and applied in the thermal protection system and control surfaces of Space Rider of which CIRA is the Design Authority.

Intellectual property information:

Italian Patent n. 102019000011760 granted on 07.07.2021.
European Patent n. 3766691 granted on 17.05.2023 (France and Germany)
Patents are owned by CIRA SCPA and Petroceramics SPA.

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