ESRF	**Experiment title:Evolution of structural properties of a porous C/C composite preform during chemical vapour infiltration**	**Experiment number**: HS-893
Beamline: ID 19	**Date of experiment**: from: 25-04-98 to: 26-04-98	**Date of report**: 19-07-99
Shifts: 3	**Local contact(s)**: José Baruchel	*Received at ESRF:*

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Report:

Three shifts were allocated for preliminary tests of X-ray computerised microtomography of partially densified C/C composite preforms. 7 samples extracted from a single preform displaying marked density differences were examined at 0.8 µm, 1.8 µm and 6.65 µm resolutions using a monochromatic beam (7 keV, 9 keV or 12keV) obtained using either a classical double-crystal setup, or a bent multilayer device, which decreases strongly the acquisition time. 900 projections were acquired each time using a Gd_2O_3S:Tb scintillator, a light amplification setup and a FRELON CCD camera with 1024x1024 square elements and 14-bit dynamics [1]. Some 3D images have been already obtained with the use of a filtered back-projection program developed by CREATIS [2], and other ones are still to be made.

The first results are the following :

1. The mean fibre diameter being 7 µm, acceptable resolutions have been attained. This may be easily viewed at fig.1 : the coated fibers are well distinguishable at 2 µm resolution.

2. Important phase contrast artifacts do exist, which prevent a direct use of the image for subsequent computations. This is also very clear from fig. 1. Indeed, computing transport properties inside such images would require to delineate a continuous interface

between solid and void phases ; this is not the case here. However, an image treatment procedure has been designed to extract the pertinent information out of such data and is currently under validation. An example is shown at fig. 2.

It appears from these first results that the CMT images obtained at ESRF ID 19 on C/C composite preforms are of a sufficient quality (provided an appropriate post-treatment) to be used in further 3D computations concerning i) geometrical characterisation (porosity, surface, curvature, etc ...), ii) transport in the void phase (diffusion, viscous transport, or Knudsen) and iii) deposit growth simulations. This will be the subject of forthcoming papers.

The work presented here has been developed under the general approach of the thematic group CM3D in Bordeaux, which intends to apply similar methods to many application fields such as sandstone diagenesis [3] and sintering of ceramics [4].

References :

1. ESRF Newsletter n° 25, March 1996, pp 41-43.

2. "Volumic" software, by CREATIS UMR CNRS-INSA Lyon 5515. See also : F. PEYRIN , L. GARNERO, I. MAGNIN, "Introduction à l'imagerie tomographique 2D et 3D reposant sur une propagation en ligne droite: cas de la tomographie par rayons X, par émission et par ultrasons", Traitement du Signal **13**(4), p. 381-413, 1996 supplementary issue (1996).

3. ESRF Proposal n° HS-891

4. ESRF Proposal n° HS-892

Figures

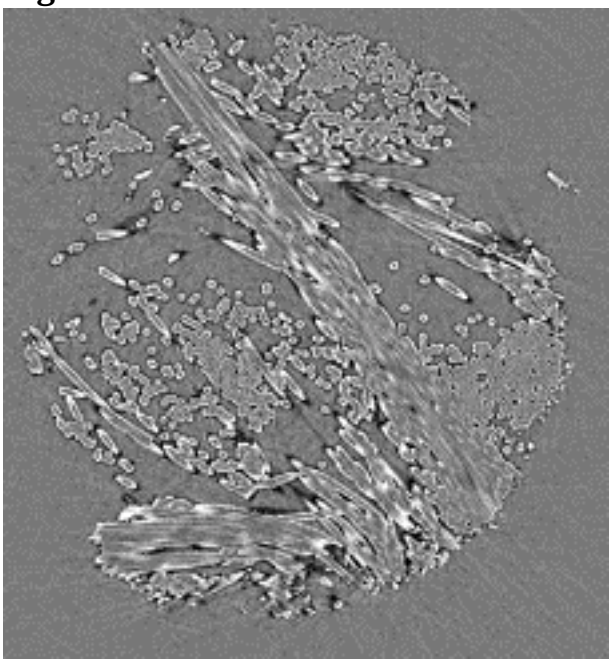

Fig. 1 : 2D slice of a tomographic scan of a partially densified C/C preform. Image size : 1024x1024 pixels. Pixel size : 1.8 µm.

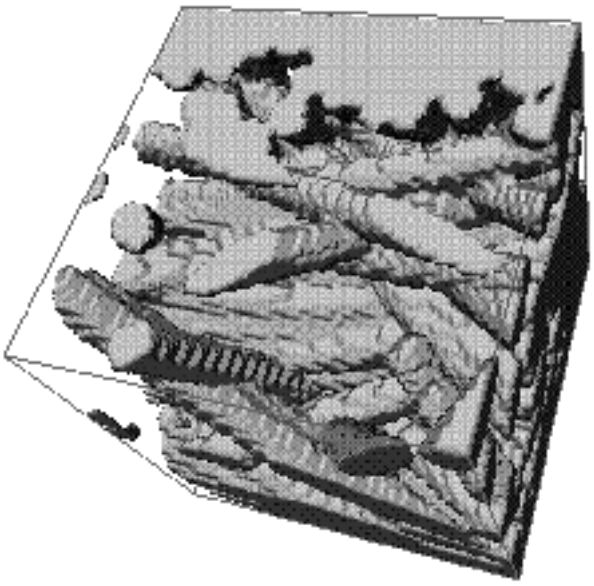

Fig. 2 : 3D representation of part of the fibrous architecture, obtained after treatment of the same data set as in fig. 1. Image size : 80x80x80 voxels. Pixel size : 1.8 µm.