

Production of GFRP Air Ducts Using Lightweight Gypsum Patterns Removable in a Recyclable Way

L. Boccarusso^{1, a)}, G. Candida^{2, b)}, M. Durante^{1, c)}, F. Iucolano^{1, d)}, A. Langella^{1, e)},
F. Memola Capece Minutolo^{1, f)}, D. Mocerino^{1, g)}, M. Pagnano^{2, h)}

¹*Department of Chemical, Materials and Production Engineering, University of Naples Federico II, Piazzale
Tecchio, 80, 80125 Naples, Italy.*

²*Lavorazioni Materiali Compositi (LMC S.P.A.), Via XI settembre 2001, 40, 80030 Mariglianella (Naples), Italy*

^{a)}*Corresponding author: luca.boccarusso@unina.it*

^{b)}*g.candida@lmc-spa.com*

^{c)}*mdurante@unina.it*

^{d)}*iucolano@unina.it*

^{e)}*antgella@unina.it*

^{f)}*capece@unina.it*

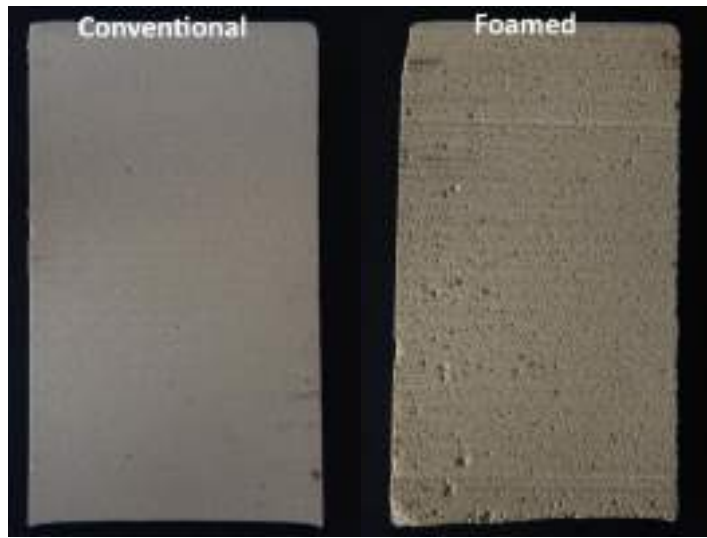
^{g)}*dav.mocerino@studenti.unina.it*

^{h)}*m.pagnano@lmc-spa.com*

Abstract. Nowadays every industrial company needs to decrease the materials waste and increase their recyclability, especially in the composite manufacturing field, where the environmental aspects is deeply felt. Currently a lot of composite ducts, used for example for aeronautical applications, are produced via autoclave and in some cases gypsum is used as material for patterns to confer the final geometry, see Fig. 1a. In these cases, the most common and fast procedure to remove the gypsum patterns is through its immersion in a water tub involving large amount of wasted gypsum to dumps. Therefore, this paper aims to make more environmental friendly the production of GFRP air ducts by reducing the raw material and to make in the same time faster and more recyclable the removing process of the gypsum patterns. For this purpose, a vegetable surfactant (in different weight percentages) with foaming power was added to the gypsum mixture in order to produce a lighter gypsum and reduce the raw material. In Fig. 1b cross sections of cylindrical samples with and without the foaming agents are illustrated. In addition, to remove the gypsum patterns also allowing its recyclability, an innovative vibration technique was proposed. In this technique, a vibration load was applied inside the gypsum pattern in order to destroy it without damage the GFRP sample. The gypsum pieces are then available for the recycling decreasing the amount of wasted gypsum to dumps. The feasibility of the process was investigated and the mechanical properties in terms of flexural and compression strength, before and after a recycle for both the conventional gypsum and the foamed ones, were studied.



a



b

Figure 1 GFRP sample after the autoclave process (a), and typical cross section of conventional and foamed gypsum samples (b).