

Development of In Mold Coating Clear Coat Paint for Carbon Fiber Sheet Molding Compound Roof

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Carbon Fiber Reinforced Plastic (CFRP) is used for various products in the aerospace and sports industries due to its superior specific tensile strength and specific rigidity. With increasing attention to Carbon Neutrality (CN) in the world, vehicle electrification and lightweighting are expanding. As a result, the application of CFRP to luxury cars, electric cars, and sports cars, is increasing. For example, CFRP is used on Lexus LC and RC-F, and Toyota 86 GRMN. However, there are two technical concerns. The first is its durability, which is caused by CFRP resin characteristic. The second is poor appearance, which is caused by CFRP surface pinholes. In order to secure good durability and surface appearance, CFRP must be pre-treated before painting (putty applied as a filler for plastic surface coverage, followed by surface sanding) and needs multiple painting steps. Current painted CFRP is not suitable for mass production due to this long and complicated process. As a result, CFRP is applied to limited vehicles. In this report, we will explain an In Mold Coating (IMC) paint and molding process that enables the manufacture of Carbon Fiber Sheet Molding Compound (C-SMC) roof molding and painting at once.

For vehicle lightweighting and also for obtaining a low center gravity, a carbon fiber reinforced plastic (CFRP) roof is effective. As a result, the application of CFRP roof is increasing. However, CFRP is not used for body outer panels without painting because of poor durability and appearance. In order to secure good durability and surface appearance, CFRP must be pre-treated (putty applied as a filler for plastic surface coverage, followed by surface sanding) before painting and requires multiple painting steps. For these reasons, it is used only for limited vehicles. In order to expand application, process shortening is required. Carbon Fiber-Sheet Molding Compound (C-SMC) is a sheet-like material in which carbon fibers are cut into several centimeters in length and dispersed in a resin. C-SMC can be processed into parts in a short time (about 2 to 5 minutes) by compression molding. In Mold Coating (IMC) is a process which can achieve both resin molding and painting on the resin surface at same time (Fig. 1). As explained above, when painting CFRP, it is necessary to apply different functional paints, so the only layer that could be applied with IMC was a primer with a pinhole hiding function. We have developed a new IMC clearcoat paint for C-SMC roof, which ensures the same qualities as the conventional multi-layer painting system and further enables the process shortening (Fig. 2).

In this article, we examined the development of IMC clear paint and its method, and found an IMC paint composition and method that can achieve both film and adhesion performance on C-SMC substrate. It has been shown that C-SMC molding and IMC condition, reaction rate of C-SMC substrates and IMC paint composition are very important for securing film formability and adhesion performance.

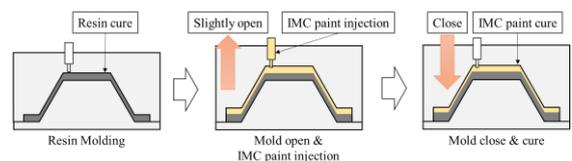


Fig.1 IMC process

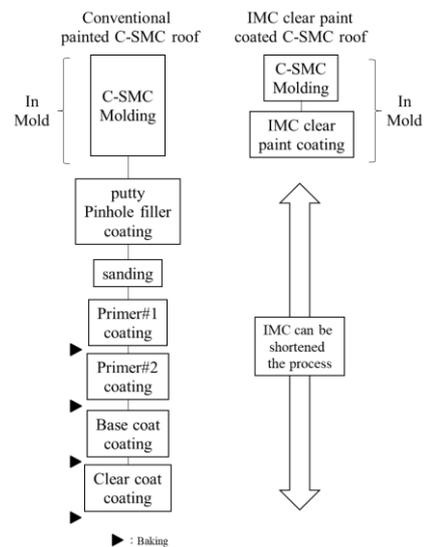


Fig.2 IMC clear paint coated C-SMC roof and Conventional painted C-SMC roof manufacture process