Evaluation and Application of Sustainable Nylon Resin – A Case Study on Components in Transportation Refrigeration Systems

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Abstract:

Companies worldwide are increasingly recognizing the reduction of embodied carbon as a crucial strategy to achieve Net Zero emissions, and as a growing priority to address global climate change. The heating, ventilation, and air conditioning (HVAC) original equipment manufacturers (OEMs) are part of the industry that utilizes a large volume of plastic components. As a global climate innovator, Trane Technologies has set a sustainability goal to reduce embodied carbon emissions by 40% and design systems for circularity by 2030. To support this objective, a cross-functional team collaborated on a project to evaluate and implement recycled nylon resins in multiple components on the Precedent® transportation refrigeration units sold by Thermo King®, one of Trane Technologies' strategic brands.

As a progressive step towards a 40% reduction in embodied carbon, two types of recycled resins of the nylon family were evaluated as alternatives to the incumbent resins made from 100% virgin nylon. These alternative resins, sourced from various suppliers, are composed entirely of either post-industrial or post-consumer recycled nylon. The project is currently in the final testing phase on various plastic components. This paper provides a detailed discussion of the evaluation process, including assessments of mechanical properties, UV resistance, and molding trials. The investigated recycled resins demonstrate comparable performance in terms of functionality and processability. By transitioning from virgin nylon to recycled nylon, we estimate a 30% reduction in total embodied carbon can be achieved. Additionally, over 350,000 pounds of scrap and recycled material will be reused within our supply chain annually.

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