Molded fiber dual ovenable containers

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ABSTRACT: Molded fiber containers have been developed to provide dual ovenable service for a range of dinner and entree requirements. The unique characteristics of fiber molding provide smooth contours for uniform microwave heating and precise multiple compartment designs at a high strength-to-weight ratio. The product has the highest content of biodegradable material, is readily compostable after use, and weighs considerably less than other packaging options. Its two-ply laminated construction allows excellent customer decorating.

KEYWORDS: Containers, cellulose, composites, design, fibers, microwave ovens, molding, ovenable packages, packaging, plastics.

Social changes and the spectacular sales of microwave ovens have promoted substantial growth in the single-serving frozen dinner and entrees industry in the last decade. The two basic requirements of a dual ovenable container used in frozen entrees/dinners are these:

- To have proper physical properties to withstand conditions on the food processing line and in the freezer
- To withstand abrupt heating in a microwave or conventional oven.

The container must also be attractive and function well as a serving dish.

Because molded fiber dual ovenable containers meet these requirements, their sales have grown from practically zero to hundreds of millions of units per year. Now, continuing changes in customer demands and environmental concerns have created both challenges and opportunities to the food and packaging industries. The following article discusses some basic characteristics of today's molded fiber dual ovenable containers and their functional and environmental characteristics.

Container structure and raw material

The molded fiber dual ovenable container is made of a composite consisting of both cellulose fiber and plastic. The food-contact surfaces of the molded fiber container are laminated with an overlay of thin polyester film. This high-heat resistant film provides a moisture and oil barrier between the food and the tray, while the fiber base tray provides strength and rigidity.

The fiber base tray is molded from bleached chemical fiber recovered from recycled materials. Primary raw materials are trimmings and packaging overruns from products such as milk cartons and food cartons. The molded tray contains primarily amorphous hemicellulose and cellulose, and crystalline cellulose. The glass transition temperature ranges from 165°C to 225°C for amorphous hemicellulose and 230°C for amorphous cellulose.[1] The crystalline cellulose does not soften until it melts at 450°C.[2] Due to the relatively high glass transition temperatures of celluloses, the molded fiber container is dimensionally stable and encounters little loss in impact or rigidity throughout the freezing to heating product cycle ranging from -40°C to 230°C.

Container design and decoration

The fiber container can be produced in practically any shape and pattern, in either single or multicompartment style. Since each container is three-dimensionally molded individually as one piece without any additional stretching or post forming, it has continuous and smooth contours. This feature promotes uniform heating of the food, especially in microwave ovens. The fiber base container can also be colored and rim printed according to the customer's graphic design. Additional full surface decorations with a reverse printed laminate film is also available. Final container design is selected to maximize the strength-to-weight ratio for the required container capacity.

Weight reduction

As a result of the molding process, fiber trays are relatively light in weight but high in strength. In practice, this characteristic allows for a much lighter

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weight molded fiber container to be used for the same application.

In **Table I,** typical weights of molded fiber and crystallized polyethylene terephthalate(CPET) trays are compared according to sizes. Tray weight is reduced by at least 25% and as much as 49% when molded fiber containers are used. In **Table II,** comparisons are made between dual ovenable molded fiber and pressed paperboard containers for a 16.5 x 12.7 cm tray. In this example, fiber reduction is 32.6% and plastic liner reduction is 27.3% when a molded fiber container is used.

Despite its much lighter weight, the molded fiber dual ovenable container maintains its impact strength during food processing and distribution at low temperature and does not soften or melt during heating in the microwave/ conventional oven.

I. Comparison of typical article weight between dual ovenable molded fiber container and CPET tray

Container size	Number of compartments	Tray weight (g)		% reduction*
		Molded fiber	CPET	
20.32 cm Round	1	24.5	33.5	26.9
	3	18.4	32.0 – 36.2	42.5 – 49.2
19.05 cm x 13.57 cm	1	15.9	26.9	40.9
	2	16.8	22.4	25.0
17.78 cm x 22.86 cm	4	20.3	28.0 – 35.5	27.5 – 42.8

* % reduction = CPET tray weight - molded fiber tray weight x 100%
CPET tray weight

II. Comparison of dual ovenable containers made of molded fiber and pressed paperboard

Container size	No. of compartments	Base plate weight (g)		% Reduction	Polyester film (g)		% Reduction
		Molded fiber	Paperboard		Molded fiber	Paperboard	
16.51 cm x 12.7 cm	1	12.0	17.8	32.6	0.8	1.1	27.3

Biodegradable product

The molded fiber dual ovenable container has the highest biodegradable content among all trays used in the frozen entree/dinner industry. Over 90 wt. % of the container is natural cellulose fiber. Cellulose is a carbohydrate, consisting of carbon, oxygen, and hydrogen in its molecular structure, and it can readily biodegrade under controlled or natural conditions. As a result, products based on cellulose fiber are good compost material. Trials in a commercial composting facility confirmed that the molded fiber dual ovenable containers decompose quickly under ordinary composting conditions. Residual film can be screened easily.

Conclusions

Combining unique characteristics of the molding process and cellulose fiber, the molded fiber dual ovenable container demonstrates excellent properties for the application. It is also an environmentally responsible packaging option for the single-serving frozen entree/dinner industry. ■

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