



Research News

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Contact: Tsunehisa Miki
tsune-miki@aist.go.jp

AIST Technology Makes It Possible To Mold Wood

AIST, one of the largest public research organizations in Japan, focuses on the creation and practical realization of technologies useful to Japanese industry and society, and on “bridging” the gap between innovative technological seeds and commercialization.

Wood-Based Sustainable Composites Group in AIST have been developing basic technologies for wood-based composites aiming at building and automotive applications that improve the energy efficiency as well as the comfortability based on materials science and industrial aspects.

■About the world’s first technology “wood flow molding process”

The “wood flow molding process” is a patent technology originally developed by AIST. In this shaping technique, a solid wood contained with specific chemicals is hot-pressed in a mold, causing deformability and fluidity of wood to make a shape along the mold.

Since wood resources are renewable and sustainable if properly planned forestation and deforestation are performed, wood-based materials can contribute to global environmental issues such as carbon neutrality. Toward achieving the 2050 challenge, requirements of application expansion of wood based materials have been increasing, for example wood can be shaped and use like plastic and metal materials respectively.

AIST discovered that a solid wood generated a large deformability and showed fluidity under certain humidity, temperature and pressure conditions on a study of the basic physical properties of plant materials, and has developed the technological seed for "wood flow molding" using this phenomenon. We have been conducting various studies to improve this technology based on composites approach and have tried to make wood to be an industrial material through wood flow molding.

Research & developments have been carried out on the application of flow-molded wood to automobile interiors, construction, and daily necessities, taking advantage of the characteristics of its light weight and strength comparable to reinforced plastics, which far exceeds that of natural wood

properties.

Fig.1 shows a composite process based on impregnation of a functional matter into wood. In this process, a functional matter such as pre-polymer or oligomer introduced into wood cells with adsorbents in the first step, and then polymerized in wood cells. A solid wood in a swollen state processed like impregnation generates large deformability under hot-pressing as shown in Fig. 2. This plastic deformation is derived from mutual position changes among wood cells along intercellular slip bands, while there is little damage on wood fibrous cell.

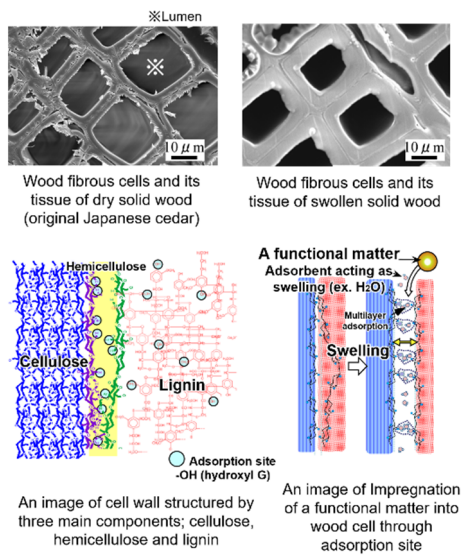


Fig. 1 A composite process based on impregnation of a functional matter into wood.

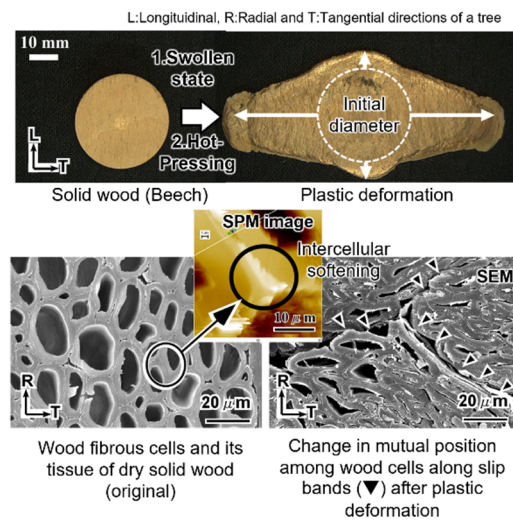
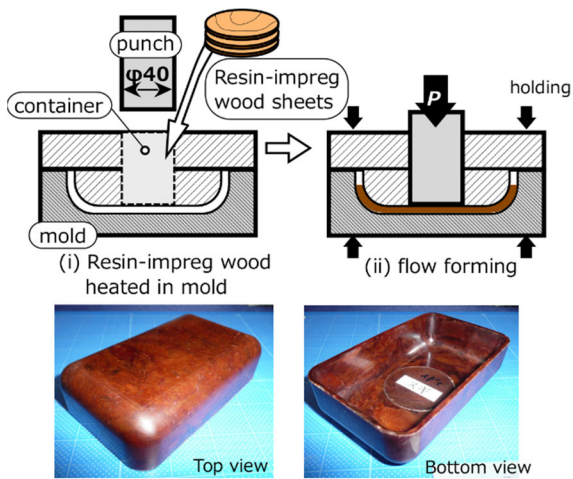


Fig. 2 Large deformability of solid wood under hot-pressing.

Fig. 3 illustrates SMC molding process of wood impregnated with a thermosetting resin. (i) Uncured resin-impregnated wood sheets are set up in a hot mold, and then immediately are pressed by a hot punch (ii). During hot pressing, impregnated wood is flowed in a cavity up to complete filling. After curing SMC molding of impreg wood, a 3 D wood product can be obtained with improved properties compared to original wood.

Examples of wood based composite prepared by hot pressing of various types of impreg wood are shown in Fig. 4. Using conventional plastic forming as well as polymer composite techniques, resin impregnated solid wood with higher wood content around 70 % can be shaped which contributes to storage carbon dioxide as wood elements in the products.

Furthermore pursuing the multi-material process with other industrial materials based on wood composite techniques enable creating feasible and scalable applications.



(iii) SMC molding of resin-impreg wood

Fig. 3 SMC molding of resin impregnated wood (impreg wood).



Fig.4 Examples of wood-based composites prepared by various type of impreg wood.

Link :

<https://unit.aist.go.jp/mmri/en/groups/suscom.html>

https://www.aist.go.jp/aist_j/press_release/pr2018/pr20180205/pr20180205.html

<https://www.youtube.com/watch?v=iz6rWSKyHKE&t=7s>