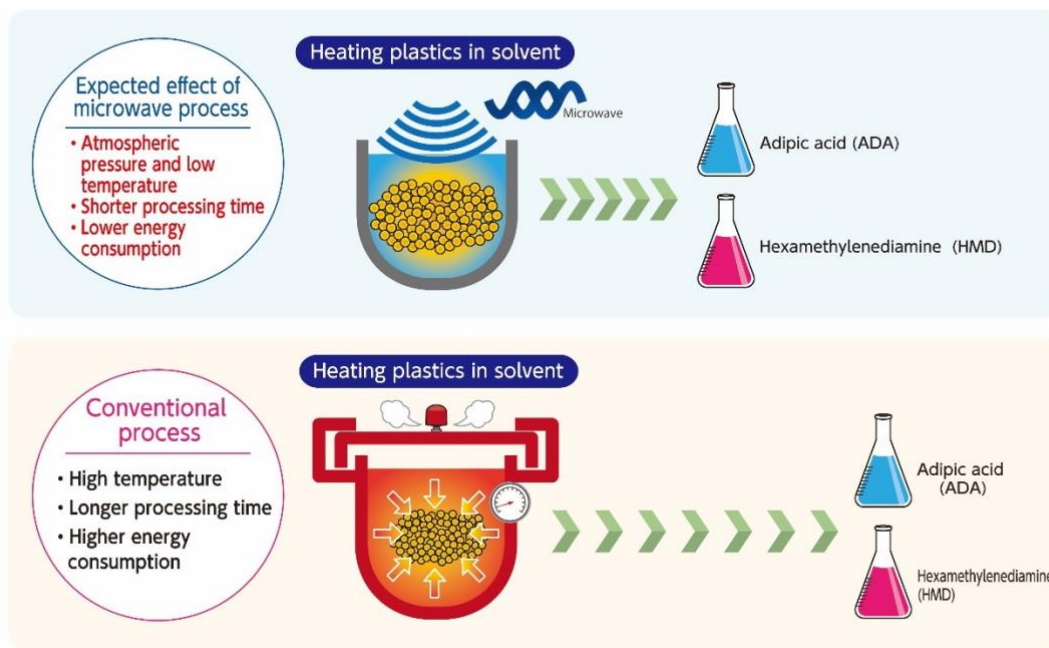


April 27, 2023
Asahi Kasei Corp.
Microwave Chemical Co., Ltd.

Asahi Kasei and Microwave Chemical launch joint demonstration project for chemical recycling of polyamide 66 using microwave-based technology

Asahi Kasei and Microwave Chemical launched a joint demonstration project in April 2023 with the objective of commercializing a chemical recycling process for polyamide 66¹ (PA66, also called nylon 66) using microwave technology. The process utilizes microwaves to depolymerize² PA66 and directly obtain the monomers hexamethylenediamine (HMD) and adipic acid (ADA), which is expected to be accomplished at high yield with low energy consumption. The monomers obtained can then be used to manufacture new PA66. In the demonstration, scraps from manufacturing and post-use waste material of PA66 for airbags and automobile parts are depolymerized.

Chemical decomposition of polyamide 66 using microwave technology



Asahi Kasei currently produces fossil fuel-derived HMD and ADA as intermediates to manufacture Leona™ PA66³, an engineering plastic featuring outstanding heat resistance and rigidity. PA66 is used in various applications, including plastic parts for automotive and electronic products, and yarn for airbag fabric, and its demand is expected to increase worldwide.

As the world moves toward carbon neutrality, attention is increasingly focused on manufacturing processes for reducing greenhouse gas (GHG) emissions from chemical products derived from fossil fuels. Microwave Chemical is promoting technological and business development to achieve carbon neutrality in the industrial sector focused on process development using microwaves, which can directly and selectively heat target

substances with high energy efficiency. For chemical recycling, Microwave Chemical is advancing its proprietary PlaWave™ technology platform for decomposing plastic using microwaves.

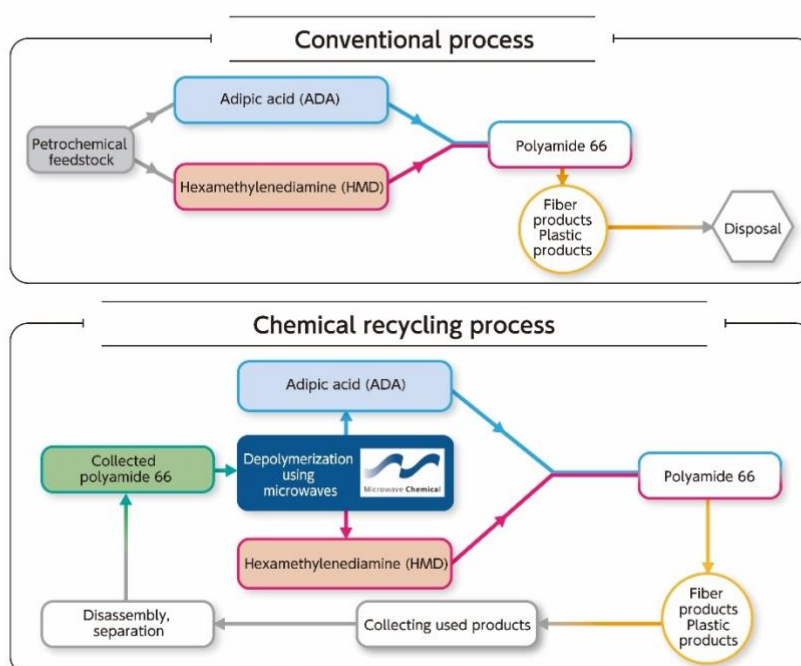
Through development combining Asahi Kasei's experience in manufacturing HMD and ADA for more than half a century together with Microwave Chemical's achievements in the industrialization of microwave technology, the two companies aim to commercialize a manufacturing process for PA66 that can reduce GHG emissions compared to the conventional manufacturing process.

Laboratory-scale studies that began in fiscal 2021 have confirmed the high-yield depolymerization of PA66 using microwaves, as well as the principle of the separation and purification process after depolymerization. Bench-scale equipment will now be assembled at Microwave Chemical's Osaka Factory by the end of fiscal 2023, and a small-scale demonstration trial using this equipment will be performed in fiscal 2024 to collect basic process data for commercialization.

Microwave Chemical's PlaWave™ technology platform for decomposing plastic using microwaves can depolymerize PA66 with low energy and obtain HMD and ADA monomers in high yield. The manufacturing process for PA66 using HMD and ADA obtained by depolymerization with this technology is expected to reduce GHG emissions compared to the conventional PA66 manufacturing process, while further reduction of GHG emissions may be achieved by the use of renewable energy for the power required to generate the microwaves.

By verifying the process from depolymerization to separation and purification in an integrated manner, this demonstration project aims to enable resource circulation of PA66 for further reduction of GHG emissions.

Comparison of conventional polyamide 66 manufacturing process with chemical recycling



Moving forward, based on the results of the small-scale demonstration trial, a decision on the possibility of commercialization will be made by fiscal 2025 following detailed analysis. Concurrently with the small-scale demonstration trial, construction of a business model that involves the entire value chain in the chemical recycling of PA66 will be advanced, aiming to achieve a circular economy together with stakeholders in the PA66 value chain.

Asahi Kasei aims to be a global partner for its PA66 customers by providing optimal solutions for their carbon neutrality initiatives through studies of the practical application of material recycling and chemical recycling as well as trials for the commercialization of PA66 made using biomass-derived intermediate⁴.

Microwave Chemical is working to increase the scale of equipment and to make PlaWave™ more generally applicable in order to achieve the practical application of the chemical recycling of polymethyl methacrylate (PMMA, also called acrylic resin), automotive shredder residue (ASR), plastic containers and packaging, flexible polyurethane foam, etc.

¹ The main types of polyamide are polyamide 66 and polyamide 6, which have different chemical structures. With superior heat resistance and strength, polyamide 66 is widely used in industrial applications such as automotive and electronics.

² The opposite of polymerization, depolymerization is the process of breaking down a polymer into a monomer or monomers by heat and other means.

³ Asahi Kasei is a manufacturer of engineering plastics such as polyamide 66, which is made from HMD and ADA, polyamide 6I, and polyamide 612, as well as polyamide 610, which is made based on plant-derived raw materials such as castor oil, and supplies optimal materials suited to various needs ranging from molding materials for automotive and electronics applications, airbag yarn and fabric, and tire cord.

⁴ Please refer to the press releases dated March 16, 2022:
Genomatica and Asahi Kasei Partner on Renewably-Sourced Nylon 6,6
https://www.asahi-kasei.com/news/2021/e220316_2.html
Asahi Kasei to accelerate trials for commercialization of polyamide 66 made using biomass-derived intermediate
<https://www.asahi-kasei.com/news/2021/e220316.html>

Engineering Plastics at Asahi Kasei
<https://www.asahi-kasei-plastics.com/en/>

Fibers & Textiles at Asahi Kasei
<https://www.asahi-kasei.co.jp/fibers/en/>

About microwaves

Microwaves are electromagnetic waves that are frequently used for microwave oven and communication applications and able to transfer energy to materials directly and selectively. In 2014, Microwave Chemical achieved the world's first successful construction and operation of a chemical plant using microwaves. By combining the microwave process with electricity derived from renewable energy, GHG emissions reduction of 90% is possible, making this a promising technology for achieving carbon neutrality.

About PlaWave™

PlaWave™ is Microwave Chemical's proprietary technology platform for decomposing plastic using microwaves, that is able to be applied both to pyrolysis and solvolysis. PlaWave™ enables faster reaction speeds and greater energy efficiency in a more compact device. The PlaWave™ logo is inspired by the desire to create a green circular economy with the aid of microwaves.



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