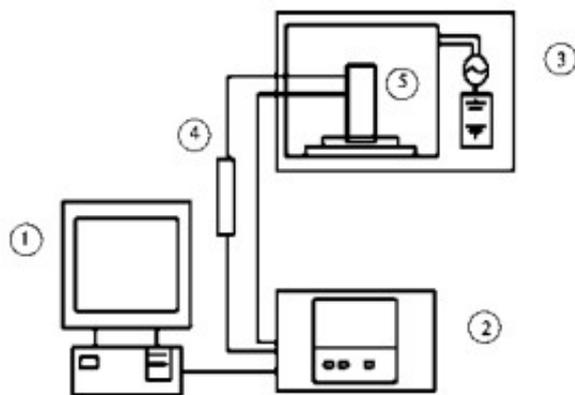


# Application of microwave technology in wood processing and product testing in China

Abstract: The research achievements and application status of [microwave drying equipment](#) in wood drying, wood modification, adhesive synthesis, material defect detection, moisture content detection of bamboo and wood products and formaldehyde emission detection of wood-based panels in China were summarized. It has the advantages of shorter heating time, better drying quality and higher yield; microwave modification technology can give bamboo wood some special functions, make low-grade bamboo wood high-grade, so as to effectively use bamboo wood materials, improve economic value; synthesize adhesive by microwave technology, reaction speed is faster than traditional addition. The development trend and application prospects of microwave technology in wood drying, wood modification, nondestructive testing, extraction formaldehyde emission detection were put forward.

Key words: microwave technology; wood industry; drying; detection

[Microwave drying wood](#) technology is one of the important achievements in the field of modern scientific research. After nearly ten years of development, it has become a relatively mature discipline. Microwave technology has the advantages of high efficiency, uniformity, environmental protection and energy saving. It is widely used in environmental protection, biology, food, commodity inspection, medicine, agriculture, geology, metallurgy, petroleum, chemical and other industries. The application of microwave technology in wood industry has been paid more and more attention. It can greatly shorten drying time, improve wood properties, and also can quickly detect product quality. This paper summarizes the research achievements of microwave technology in wood drying, wood modification, adhesive synthesis, material defect detection, moisture content detection, formaldehyde emission detection and so on in China, providing a reference for further research and application of microwave technology.



## 1 Application of microwave technology in wood processing

### 1.1 wood drying

Microwave drying is to use the high-frequency electromagnetic wave to make the polar water molecule in the wood swing frequently to heat the material. Heat is produced directly in the interior and distributes evenly. The temperature gradient and moisture gradient of the wood are small. It has the advantages of short heating time, good drying quality and high yield. After 40 years of development, wood microwave drying technology in China has formed a certain scale.

In the 1970s, the microwave drying equipment for wood was preliminarily studied in China. Meanwhile, the microwave drying technology was explored and the manufacturing technology of microwave equipment was preliminarily mastered. A wood microwave dryer has been developed in Nanjing No. 772 Plant and a large standing wave resonant cavity tunnel wood microwave dryer has been developed in Shanghai Changzheng Wood Products Factory. The application results of these two types of microwave dryers show that microwave drying can shorten the drying time by several dozen times, but the immature equipment and technology lead to wood cracking, deformation and other defects.

In the 1980s, experts in wood drying in China made some basic research on microwave drying technology, and summarized the basic technology of microwave drying wood. Tong Yonghui and others studied the relationship between microwave power, drying time, drying speed, moisture content and drying quality. It was found that drying speed and water loss rate increased with the increase of radiation power and time, but wood drying quality did not change in a certain extent. The microwave drying standard of resonant cavity dryer for common tree species and standard sawn timber was summarized by testing the production technology of microwave drying.

In the 1990s, the production technology of wood microwave drying equipment in China has been further improved, and the safety and economy of the equipment have been improved. The WX40L series of new wood microwave dryers have been developed by Nanjing No. 772 Plant and successfully applied in more than ten factories such as Wuxi No. 2 Furniture Factory. Ye Yuhuang and so on designed a microwave drying line for bamboo material, which can be dried every hour.

115 bamboo chopsticks with kg moisture content of 20% were dried to 10% and had insecticidal and mildew proof functions. Wang Liyu studied the microwave drying technology of small-diameter round and oblique sections of *Robinia pseudoacacia*, and put forward the microwave drying technology of small-diameter round and oblique sections of *Robinia pseudoacacia*. In the 21st century, the theoretical basis, drying equipment and application technology of microwave drying have been systematically studied in China. The application of microwave drying technology in wood drying has been gradually popularized in China. Guiyang Xin Qi microwave industry Co., Ltd. has developed WBD series microwave drying machine for wood. The equipment has the advantages of good drying quality, keeping the original color of wood and high drying efficiency. It only takes 8 hours for wood with 20% initial moisture content to be dried to 10% and 40 hours for traditional drying.

The microwave drying kinetics of the wood was studied and the unsteady drying rate equation was established. The mechanism of stress release in wood drying under microwave irradiation was studied by Wang Ximing et al. The results showed that microwave irradiation could weaken the drying stress, reduce the moisture content gradient and improve the drying performance of wood. Li Xianjun studied the basic law of wood microwave vacuum drying with *Pinus massoniana*. It was found that the average drying rate of wood increased with the increase of microwave radiation power, wood density, initial moisture content of wood and vacuum degree of drying chamber.