**RFID in reusable cups: Ultrasonic welding creates the conditions for durable and sustainable systems**

Digital deposit and payment solutions are growing in importance in the catering, event and self-service industries. In order for a reusable cup to be used in these types of systems, it must be uniquely identifiable. A specific customer request from the DACH region shows how an RFID chip can be permanently and reliably integrated into the base of a polypropylene cup. The following application report describes the technical framework conditions and the selected joining approach using ultrasonic technology that were put into practice by RINCO ULTRASONICS.

**RFID enables automated deposit and payment systems**

When an RFID chip is integrated directly into the cup base, reusable cups can be uniquely identified and integrated into digital processes. Applications range from cashless payments at dispensing stations and automated deposit refunds to seamless tracking of individual cups that are currently in circulation. Operators benefit from simplified workflows, lower process costs and improved protection against misuse, such as the return of cups that are not part of the system. However, the main prerequisite here is secure, permanent and protected integration of the chip into the plastic cup.

**Technical challenges of integration into PP cups**

Reusable cups are exposed to mechanical stress, frequent washing and temperature fluctuations on a daily basis. The requirements for joints are just as challenging. The RFID chip must be permanently enclosed in a waterproof casing to ensure reliable operation even after many rinsing cycles. At the same time, it must not be possible to damage, tamper with or remove it.

Cyril Geisser, Project Manager at RINCO ULTRASONICS, explains:  
"The material itself posed a challenge: Polypropylene (PP) requires very precise definition of parameters to prevent uncontrolled melting. At the same time, the chip electronics must not overheat during welding. The customer also wanted a visually clean weld seam that would not detract from the appearance of the cup.”

**Ultrasonic welding, a reliable joining solution**

Ultrasonic welding was chosen to fulfil these requirements. This process enables targeted, localised heating of the plastic directly at the joint. This allows the PP cup base to be fused in a controlled manner without subjecting the RFID chip to thermal stress. The result is a material-bound connection that is tight, stable and tamper-proof.

The relevant process parameters – including amplitude, welding force, energy and time – can be precisely adjusted and monitored. This allows the welding process to be adjusted exactly to the material and component geometry. For easy and ergonomic handling, a special holder with a sliding table has been designed to allow for quick assembly. Short cycle times result in a process that is economical and ideal for use in automated series production.

**Added value for operators and the environment**

Ultrasonic welding can transform a conventional reusable cup into a durable, digital system element. Operators benefit from automated processes, lower operating costs and improved traceability. At the same time, the solution supports sustainable concepts, as the cups remain in circulation for a long time, which conserves resources.

“This application shows the potential of combining plastic components and integrated electronics – provided that the joining technology is precise and reliable,” explains Cyril Geisser, Project Manager at RINCO ULTRASONICS. “We are seeing an increasing demand for systems like this. In this project, the customer approached us specifically because our environmental management system is certified according to ISO 14001 and we consistently work on environmentally friendly and sustainable product solutions.”



*Reusable cup with ultrasonically welded RFID chip*

*Image: RINCO ULTRASONICS AG*

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