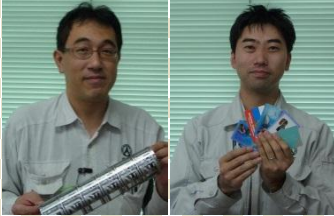


## TOYAL POLYCA (TOYAL POLYCA®)



Masataka Saruwatari and Akira Shingu, Product Development Department, Electronic Functional Materials Business Division, Toyo Aluminium K.K.



Antenna circuits

### 【 1.Introduction 】

The use of RFID cards has become widespread in recent years, including as the contactless cards for transport and for payment in convenience stores.

RFID cards have a built-in IC and a lot of information is held within the RFID card itself, which is why the applications for it are expanding. They are also convenient because it is only necessary to hold the card close to the reader/writer to be able to exchange information with the RFID, which is another reason for the expansion of their use. In particular, when handling money or points, it is possible to charge or make payments without contact, so the users do not have to make the effort of taking money out of their bag or purse, which has led to the technology's adoption by many users.

However, on the conventional type of RFID card, it is possible to use special techniques such as minning to remove the IC chip from the card.

The TOYAL POLYCA® introduced this time was developed as a solution to that problem. It is used as the antenna for RFID cards for high security applications.

### 【 2. Devices to prevent the removal of the IC chip 】

The communication between the RFID card and exterior devices is performed using specific frequencies and is managed with a considerably high level of security. However, if the IC chip can be removed from the RFID card, then the exchange and rewriting of the data becomes easier.

We therefore implemented devices to ensure that an IC chip cannot be removed from an RFID card.

First of all, the following is an explanation of the structure of the RFID card. The card has metal circuits formed on both surfaces of a base film. The base film and the metal circuits are fixed together with adhesive. This structure is called the antenna circuit. This is the part that is the Toyo Aluminium product. In the next step, an IC chip is mounted on the antenna circuit. It is then sealed at the top and bottom with a cover film to complete the RFID card.

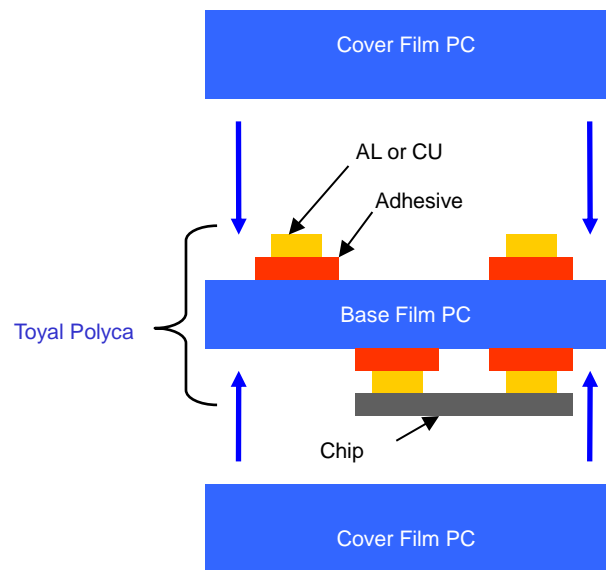


Figure 1

The final objective is to prevent the removal of the IC chip from the RFID card that has been sealed with the cover film. The method selected for this was to bond the circuit and chip with an integrated resin. The following method was implemented to achieve this.

- (1) It was decided to select the same material for the antenna circuit base film as that for the cover film and to use a material that melts in heat. In general, polycarbonate is used as the cover film and so polycarbonate was selected as the base film for the antenna circuits in this development.
- (2) In order to integrate the components, the method taken was to only use an adhesive layer between the circuit and the base film.

Figure 1 shows a structural model of each layer with this method applied. The integrated antenna circuit that is the circuit, adhesive and base film shown here is TOYAL POLYCA®. The completed RFID card state with each layer of Figure 1 integrated together is shown in Figure 2.

As shown in Figure 2, the circuit and chip are floating in a sea of polycarbonate and it is now impossible to remove the internal circuit or IC chip without destroying the RFID card itself.

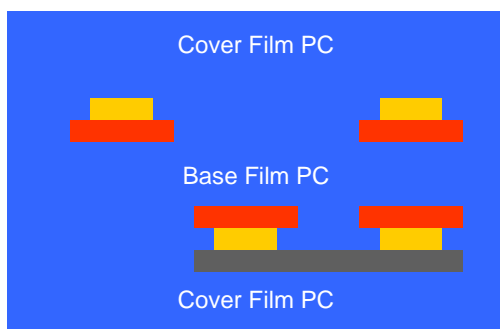


Figure 2

### 【 3. The quality of TOYAL POLYCA 】

As written above, on TOYAL POLYCA, the circuit is in a state like floating in a sea. In this state, there is a possible risk that the metal circuit itself will move. To prevent this, a solution was found with the use of a new adhesive developed for this technology. Figure 3 shows the cross section of the circuit after the RFID card has been integrated into a whole.

As shown in Figure 3, even after the integration, the circuit is held without bending.

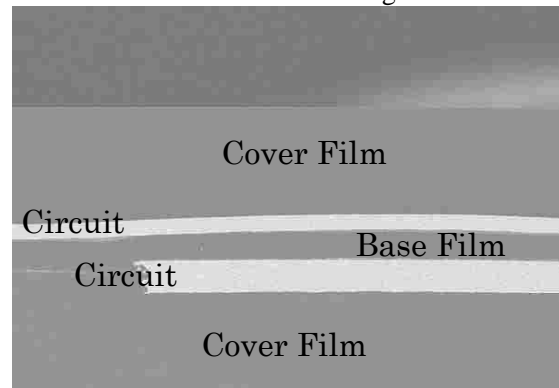


Figure 3

Furthermore, in order to only place adhesive under the circuit, the technology was completed by applying the manufacturing technologies the company has developed for food and pharmaceutical packaging and also with unique manufacturing methods and equipment.

### Patent application

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