

# Boxes of tricks

Enclosures are made of metal or plastic – right? Or is there a bit more to it than that? **Tim Fryer** looked at which materials suit certain applications and why there is a requirement for more exotic options.



**OKW's medical enclosures are made of ROTEC ASA EXP1927. This is an ASA material which contains the sterione, the active substance that allows controlled release of high activity ions.**

**M**etal or plastic? Choosing an enclosure is not as straightforward as that, so what are the options when you are looking to house your precious electronic designs? Robert Cox, sales and marketing director of OKW Enclosures, gave his opinions on the pros and cons of the major enclosure materials of construction.

## **Metal enclosures**

Die-cast aluminium enclosures are amongst the oldest types of enclosure for electronics – especially electrical equipment – and have been used for decades.

Such enclosures are mostly sealed, with protection ratings ranging from IP65 to IP69K. Cox commented: "The advantages of die-cast enclosures in aluminium are strength, lighter weight (when compared to stainless steel) and highly consistent quality of finish. The strength and torsional rigidity of the lid section means that higher sealing ratings, such as IP67 and better, can be achieved, unlike other fabricated enclosures." Typical applications include industrial test and control equipment and outdoor security and monitoring systems.

Another popular material is extruded aluminium. It is used as vertical and horizontal members for 19in racks, or as width and side profiles for instrument enclosures.

Sheet aluminium is a high quality, lightweight alternative to sheet steel. It is very useful for manufacturing small desktop and portable instrument enclosures. The material is very easy to punch and form into folded structures. "Sheet aluminium is the most popular material for enclosure front panels, even many plastic enclosures are supplied with aluminium front panels," said Cox. "This is because the material is easier to machine than steel or plastic, even with only basic drilling equipment. Also, it is a much more economic solution than plastic panels for larger batches."

Steel is commonly used for larger enclosures, like 19in racks, industrial

cabinets, wall boxes, outdoor street enclosures, electrical cabinets. Aside from the cost – it is cheaper than sheet aluminium – steel has the advantage that it is easy to punch, form, fold and weld into tough and stable structures. However, Cox points out: “For smaller housings, folded steel enclosures are simple and not particularly attractive. Steel is heavy and subject to corrosion if the finish is damaged. Generally, a combination of steel panels and extrusion profile and die-castings are employed to create attractive housings – especially small enclosures.”

Stainless steel is a specialist enclosure material. It has special anti corrosion qualities that are demanded in industries such as food production, dairy and farming, petrochemical, marine and industrial applications. Cox observed: “In addition to the right stainless steel alloy, the surface characteristics also have a decisive influence on the corrosion resistance. Optimum protection in coastal areas is afforded by clean, bright metallic surfaces that are fully passivated. But, stainless steel is an expensive and heavy material.”

#### Plastic enclosures

Plastic enclosures are made by injection moulding and the most common material is ABS Thermoplastic. It is attractive and tactile, produces high detail and fine surface finishes and can be specified with anti static properties and with flame retardant properties up to UL 94 V-0, depending upon the parts. Cox said: “Enclosure manufacturers have taken advantage of ABS to produce modern, ergonomic shapes and forms. ABS has replaced basic polystyrene, which is now rarely used.”

Polyester glass fibre reinforced (GRP) enclosures are used for industrial electronics and electrical equipment in applications when there is a risk of exposure to such things as oils, salts and acids. “The glass fibre material also provides a better impact resistance than ABS or polycarbonate (PC),” said Cox, “but GRP enclosures are generally for industrial applications

– the surface finish is not equivalent to other polymers, such as ABS or PC.”

ASA Luran may not have a surface finish quite as attractive as ABS, but it is a tough material used for outdoor enclosures which require high UV resistance; typically, outdoor monitoring or detection equipment on street furniture, buildings or masts.

Cox says another plastic, PC + ASA Thermoplastic, is: “a tough modern plastic with flame retardant properties rated up to UL 94 V-0 and ideal for outdoor enclosures in covered areas.” Two other options that Cox highlights are PMMA (IR) Plexiglas and SEBS (TPE) thermoplastic elastomers. “For infra red applications, enclosures can

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**Robert Cox**

be manufactured in an IR grade of polymethyl methacrylate (PMMA), which looks like black ABS, but has excellent IR optical characteristics.”

TPE is a thermoplastic, rather than thermosetting, material with rubber like properties. “Being thermoplastic, it is easy to mould using modern high volume injection moulding technology,” added Cox. “The TPE has a rubber like property, which is ideal for manufacturing enclosure accessories or bump resistant sections of the enclosure parts.”

#### Antimicrobial enclosures

One of the more exotic variations is a range of medical enclosures designed to attack the causes of infection. Cox explained: “In suitable environmental conditions, bacteria settle. They form strongly growing cultures, which may take over whole surfaces – the biofilm. These cultures enjoy a certain environmental humidity and continue to increase there. If they are in contact with humans, they may have a toxic effect. This process is similar with fungus spores. Surfaces covered with sterione destroy the infestation.”

OKW's medical enclosures are made of ROTEC ASA EXP1927, an ASA material which contains the sterione, the active substance that allows controlled release of high activity ions. These ions attack the metabolic systems of microbes so they can no longer breed, and then die out.

The action is permanently effective as the material's specific properties remain practically unchanged. This means the product surface has a permanent antimicrobial effect – even after machining of holes and cut outs for connectors and switches. The enclosures meet JIS Z 2801/ISO 22196 – the standardised test for anti microbial activity and effectiveness.

Cox added these enclosures have broader application. “They are suitable for any application where clean surfaces are required or where an item is handled frequently by different people – in order to reduce transmission of infections.”

#### Biodegradable enclosures

BIOGRADE FKUR plastic was designed as a biodegradable alternative to polystyrene and has similar mechanical characteristics. Cellulose, mostly provided by wood, is the main component of vegetable cell walls. By reacting cellulose with acetates, cellulose ester is produced, which is produced as synthetic fibre and, as is the case with FKUR, as a plastic. BIOGRADE compounds are preferably disposed of in an industrial composting environment. Alternatively, landfill or incineration is possible.

Cox said these enclosures are aimed at OEMs who want to decrease their carbon footprint. “The applications are the same as for our standard enclosures – this is a green alternative.”

