

Câu 1: (3 điểm)

Describes two basic materials in metal packaging:

- a) Steel (2.0 điểm)
- In the form of a low-carbon steel which is initially produced as **blackplate**.
 - This is then converted into tinplate or tin-free steel (TFS) for container and closure manufacture.
 - **TINPLATE** is created by electrolytically coating blackplate with a thin layer of tin.
 - The tin is coated on both sides of the plate in thickness to suit the internally packed product and the external environment.
 - Different thicknesses of tin may be applied to each side of the plate.
 - Tin, plated in sufficient thickness, provides good corrosion-resisting properties to steel, and is suitable for direct contact with many products
 - However, for most foods and drinks it is necessary to apply an organic coating to the inside surfaces of the tinplate container to provide an inert barrier between the metal and the product packed. This barrier acts to prevent chemical action between the product and container and to prevent taint or staining of the product by direct contact with the metal
 - The tin surface assists in providing good electrical current flow during **welding processes**. Being a very soft metal, it also acts as a solid lubricant during the wall ironing process of forming two-piece thin wall cans.
 - **TIN-FREE STEEL (TFS)**, also referred to as electrolytic chromium/chrome oxide coated steel (**ECCS**), is created by electrolytically coating blackplate with a thin layer of chrome/chrome oxide.
 - This must then be coated with an organic material to provide a complete corrosion-resistant surface.
 - The metallic layer of **ECCS** provides an excellent key for adhesion of liquid coatings or laminates to the surface.
 - **ECCS** is usually marginally less expensive than tinplate. However, being a matt surface, after coating with clear lacquer it does not provide a reflective surface like tinplate.
 - **ECCS** in its standard form is not suitable for welding without prior removal of the chrome/chrome oxide layer.

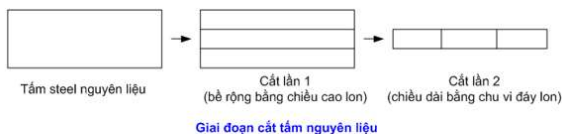
The Japanese steel makers have developed modified tin-free metallic coatings for steel that do permit satisfactory welding of this material.

- b) Aluminium (1.0 điểm)
- Aluminium for **light metal packaging** is used in a relatively pure form, with manganese and magnesium added to improve the strength properties.
 - This material cannot be welded by can-making systems and can only be used for seamless (two-piece) containers.
 - The internal surfaces of aluminium containers are always coated with an organic lacquer because of the products normally packed.

Câu 2: (3 điểm)

- a) *Trình bày* về các kỹ thuật: drawing, re-drawing và ironing (1.5 điểm)
- Drawing is the operation of reforming sheet metal without changing its thickness.
 - Re-drawing is the operation of reforming a two-piece can into one of smaller diameter, and therefore greater height, also without changing its thickness.
 - o Drawn and re-drawn containers are often referred to as DRD cans.
 - Ironing is the operation of thinning the wall of a two-piece can by passing it through hardened circular dies.
 - o The draw and wall ironing process (**DWI**) is very economical for making cans where the height is greater than the diameter and is particularly suited for making large numbers of cans of the same basic specification.

b) *Vẽ hình và giải thích* qui trình sản xuất three-piece welded can (1.5 điểm)



- Three-piece welded food cans are only constructed from steel, as aluminium is not suitable for welding by this particular process.
- Coils of steel, after delivery from the steel maker, are cut into sheets approximately 1 m².
- The cut sheets are then coated, and printed if necessary, to protect and decorate the surfaces.
- Areas where the weld will be made on the can body are left without coating or print to ensure the weld is always sound.
- The coatings and inks are normally dried by passing the sheets through a thermally heated oven where the temperature is in the range 150–205°C.
- Alternatively, for some non-food contact uses, ultraviolet (UV)-sensitive materials may be applied. These are cured instantaneously by passing the wet coating/ink under a UV lamp.
- The sheets are next slit into small individual blanks, one for each can body, each blank being rolled into a cylinder with the two longitudinal edges overlapping by approximately **0.4 mm**.
- The two edges are welded by squeezing them together whilst passing an alternating electric current across the two thicknesses of metal
- This heats up and softens the metal sufficiently for a sound joint to be made.

If the can is internally coated with lacquer it is generally necessary to apply a repair side stripe lacquer coat to the inside

of the weld to ensure coating continuity over the whole can

- For food cans, the can body now passes through a flanging machine where the top and bottom of the can body are flanged outward to accept the can ends.
- For drink cans, the top and bottom edges of the can body are necked-in to reduce the diameter prior to the creation of the flanges. This permits ends to be fitted which are

smaller in diameter than that of the can body, reducing the cost of the end and the space taken up by the seamed can

- For both food and drink cans, one end is then mechanically seamed-on to the bottom of the can body. This end is commonly referred to as the maker's end (**ME**).
- Where **easy-open ends** are fitted to three-piece cans, it is common practice for this end to be fitted at this point, leaving the plain end (non-easy-open) to be fitted after filling.
 - This practice allows the seamed easy-open end to pass through the finished can testing process. The end applied by the packer/filler after can filling is commonly referred to as the canner's end (**CE**).
- At this stage, tall food cans (height-to-diameter ratio more than 1.0) pass through a beading machine where the body wall has circumferential beads formed into it.
- **The beads provide additional hoop strength to prevent implosion of the can during subsequent heat process cycles.**
- All cans finally pass through an air pressure tester, which automatically rejects any cans with pinholes or fractures. This completes the manufacture of empty three-piece food and drink cans.

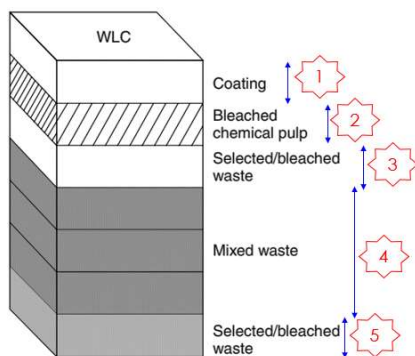
Câu 3: (2 điểm)

Trình bày và giải thích về bước xử lý Hard sizing trong chế tạo bao bì giấy

- **Sizing** is a term used to describe a treatment which delays the rate at which water is absorbed, both through the edges (wicking) and through the surface.
- It is achieved by the use of chemicals added during the stock, or pulp, preparation stage prior to forming in manufacture.
 - This is known as **internal sizing**.
- Traditionally, **alum**, a natural resin, derived from wood was used. Today several synthetic sizing materials are also available.
- Paperboard used in packaging for frozen and chilled food and for liquid packaging needs to be hard sized.

Câu 4: (2 điểm)

a) *Vẽ hình và trình bày về cấu tạo của White lined chipboard (WLC) (1.5 điểm)*



- **WLC** comprises middle plies of recycled pulp recovered from mixed papers or carton waste.
 - The middle layers are grey in colour.
 - The top layer, or liner of bleached chemical pulp is usually white mineral pigment coated.
 - The second layer, or under liner, may also comprise bleached chemical pulp or mechanical pulp.
- This product is also known as **newsboard**.

- The term **chipboard** is also used, though this name is more likely to be associated with an unlined grade, i.e. without a white, or other colour, surface liner ply.
- The reverse-side outer layer usually comprises specially selected recycled pulp and is grey in colour.
 - The external appearance may be white by the use of bleached chemical pulp and, possibly, a white mineral pigment coating. (White PE has also been used.)
 - There are additional grades of unlined chipboard and grades with special dyed liner plies for use in the manufacture of corrugated fibreboard.
- The overall content of WLC varies from about 80–100% recovered fibre depending on the choice of fibre used in the various layers.

b) *Phân tích về ứng dụng của bao bì này trong bao gói thực phẩm (0.5 điểm)*
WLC is widely used for cereals, dried foods, frozen and chilled foods, and confectionery outers.