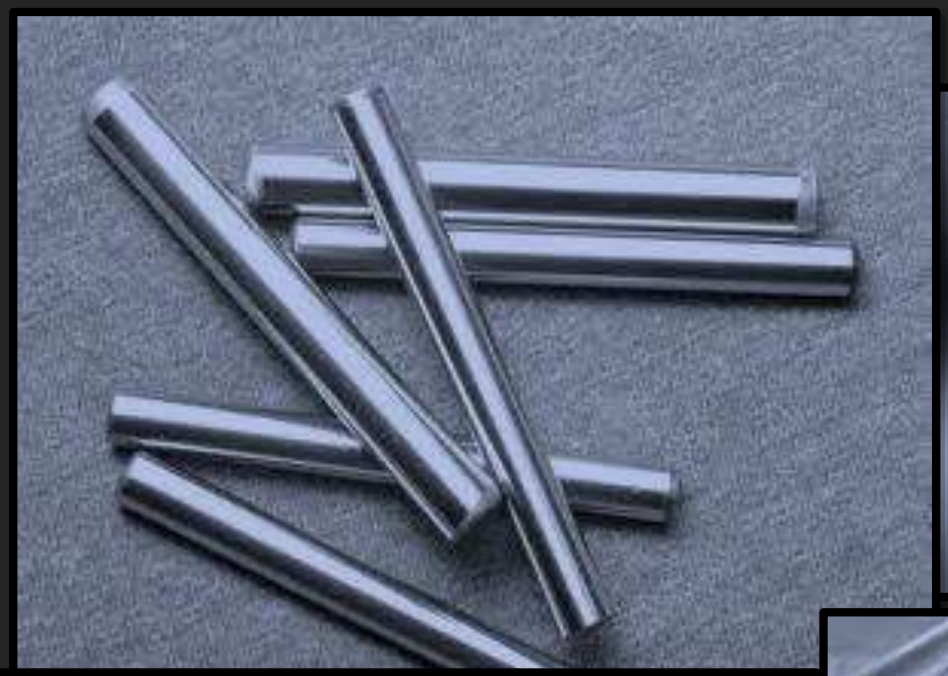
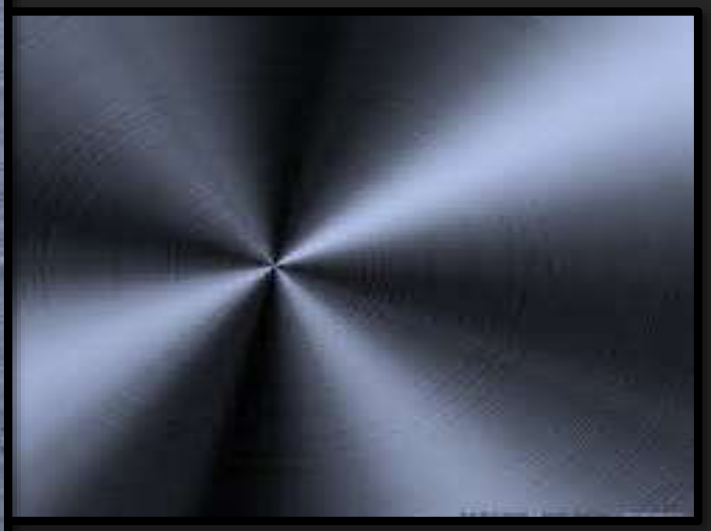
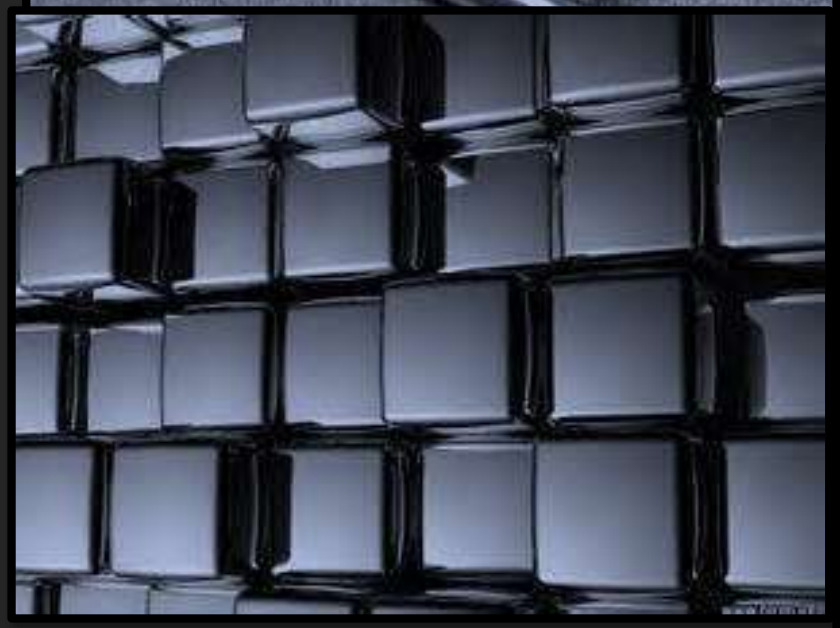






S T E E L

INTRODUCTION TO STEEL

- *Steel is basically an alloy of iron and carbon with a small percentage of other metals such as nickel, chromium, aluminium, cobalt, molybdenum, tungsten etc.*
- *Steel is a hard ductile and malleable solid and is probably the most solid material after plastic and iron.*
- *If we draw a comparison between iron and steel, we find steel in many ways even better than iron. Steel may not be as strong as iron is but it far more resistant and does not corrode and does not get rusted like iron does.*
- *There are many different types of steel classified on the basis of the type of metal used and the percentage content of the metal in the particular type of steel.*






TYPES OF STEEL

Below given are some commonly used types of steel:

- ***High-Carbon Steel***

  Carbon steel is simply composed of iron and carbon with a more percentage of carbon in it than the iron. It is probably the most commonly

- ***Mild Steel***

  It is composed of iron and carbon but it has a very low content of carbon.

- ***Medium Carbon Steel***

  The medium carbon steels has a normal content of carbon that means that they are not as hard as the high carbon and neither are they as strong the Mild carbon steel.

- ***Stainless Steel***

  Stain less steel is the most resistant and commonly used steel of all the types. It apart from carbon contains 11% chromium and some amount of nickel. It is probably the most resistant steel of all the types. The stainless steel in particular is resistant to any sort of external attack. Even a scratch cannot stay on the surface of stainless steel.

➢ ***High Speed Steel***

High speed steel is an alloy of steel which may consists of either of the following metals: tungsten, cobalt, molybdenum or chromium.

High speed steel is probably the toughest of all the types. The term high speed is given to it due to the fact that it has the ability to cut the metals.

➢ ***Cobalt Steel***

Cobalt is much like the high speed steel with an excess of cobalt present in it.

➢ ***Nickel Chromium Steel***

Nickel chromium steel is has is a special type of steel which apart from being strong s also shock resistant

➢ ***Aluminium Steel***

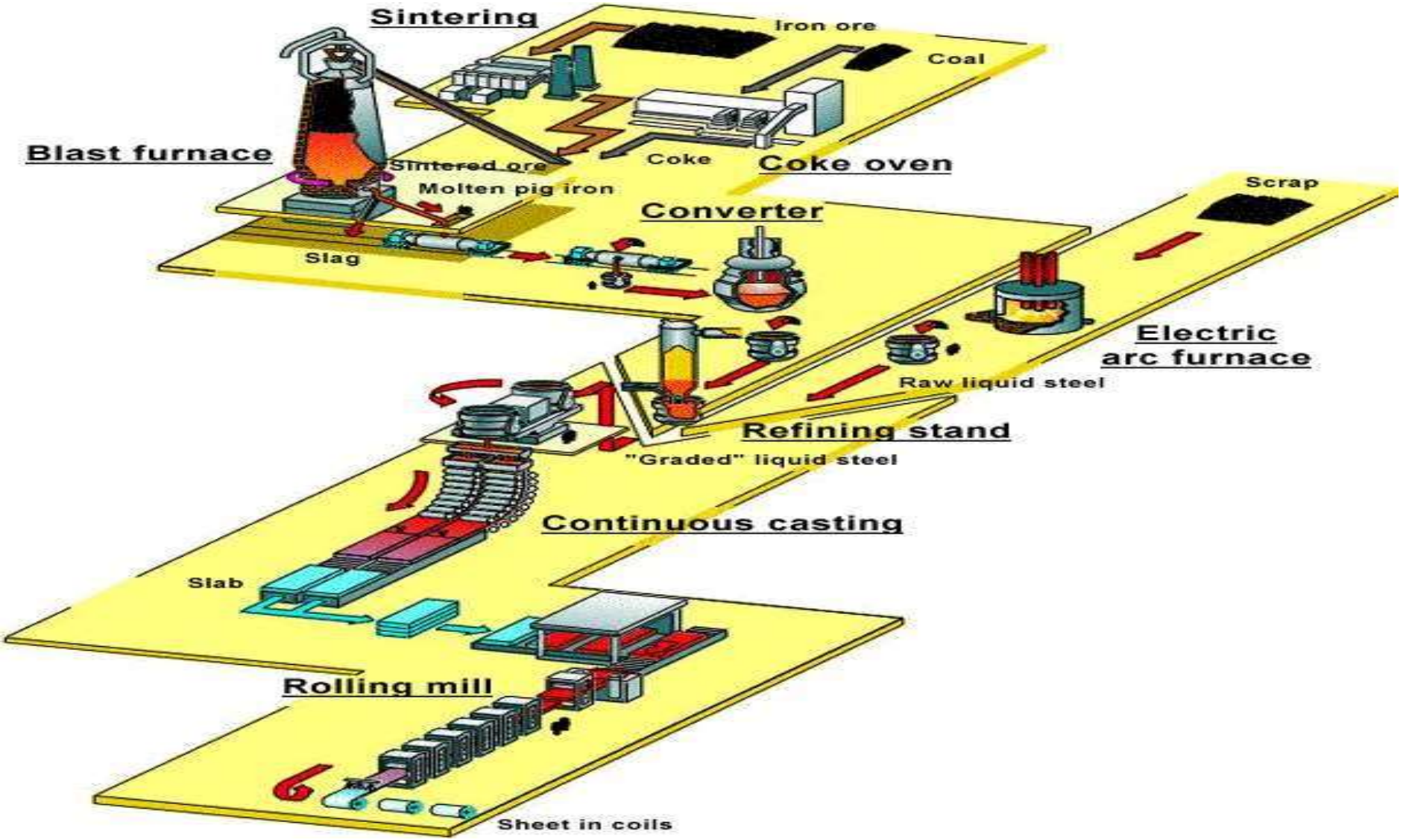
Aluminium steel is smooth steel with a high content of aluminium. Because of its strong and smooth surface it is used in the making of furniture.

➢ ***Chromium Steel***

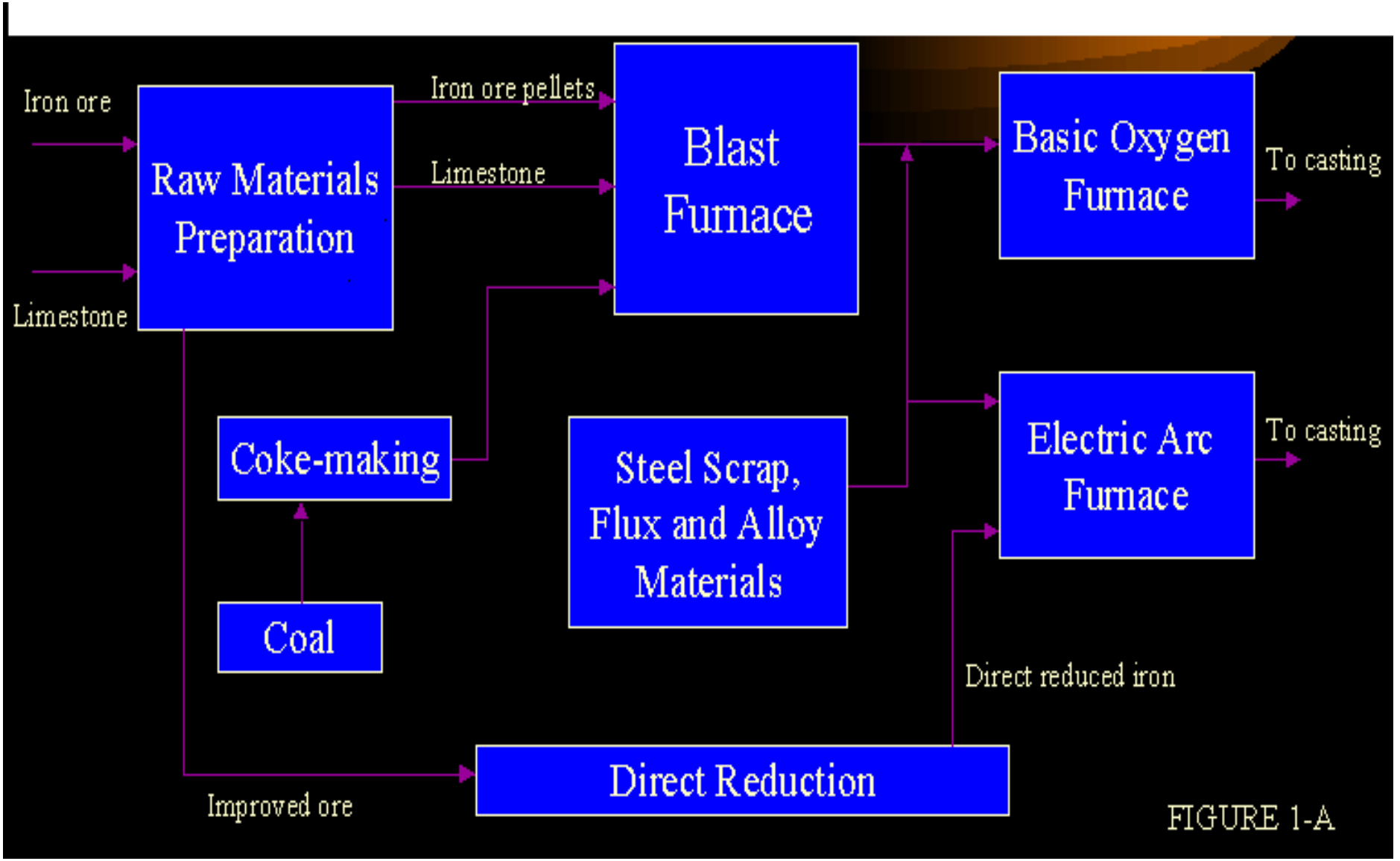
Chromium steels have a high content of chromium and are resistant to corrosion. They are very strong, tensile and elastic in nature.



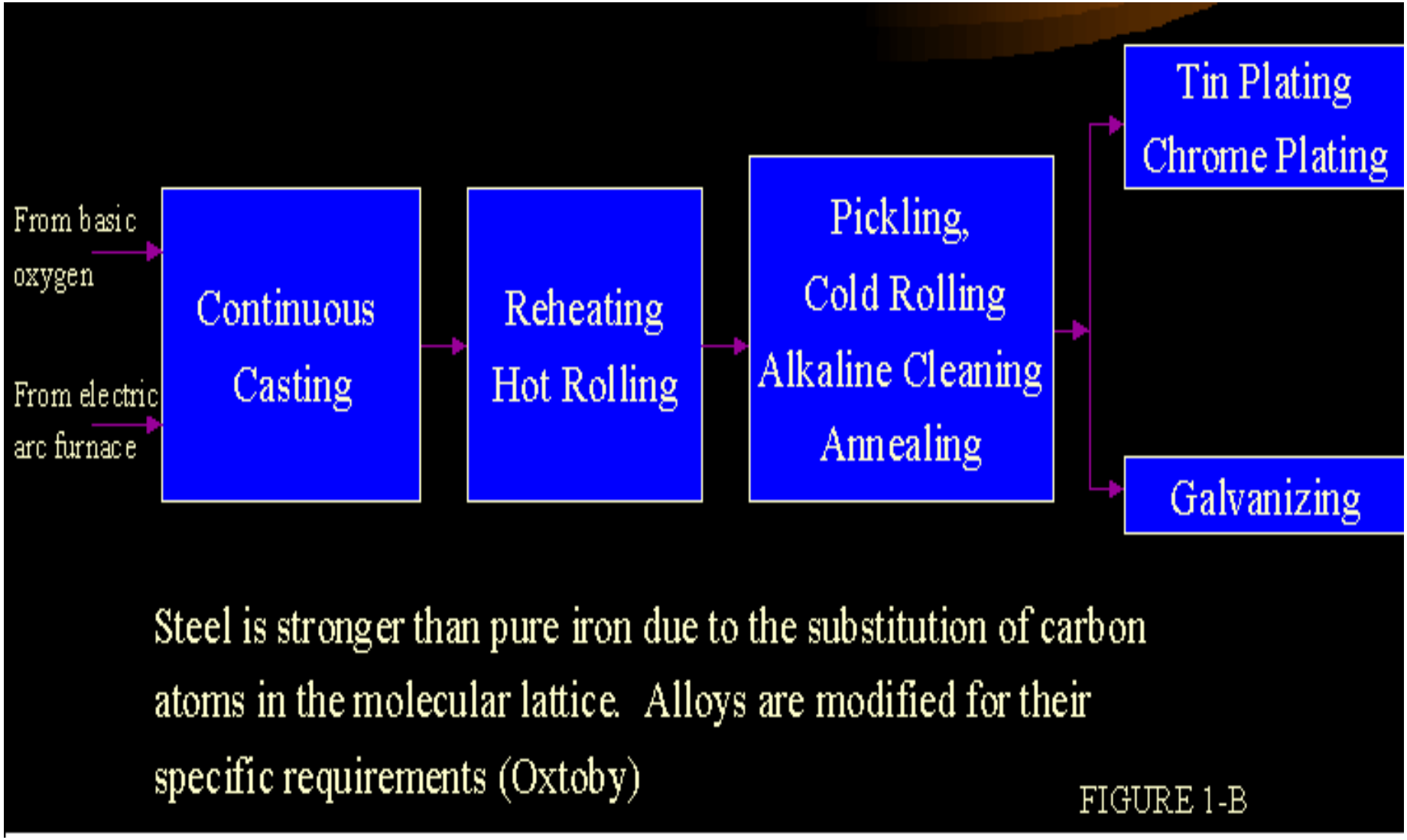

How is Steel made-I



How is Steel made-II



How is Steel made-III



Steel is stronger than pure iron due to the substitution of carbon atoms in the molecular lattice. Alloys are modified for their specific requirements (Oxtoby)

FIGURE 1-B

Steel Making Plant

Electric Arc Furnace

Ladle Furnace

Continuous Casting Machine

ARCHITECTURAL USES OF STEEL :

➢ ***Metal Buildings*****:** *Metal buildings are non-combustible and can be built out of a combination of rigid and braced steel frames comprised of both hot- and cold-formed steel shapes, plates, sheets, roof decks and panels. Each part can be custom-designed and manufactured as per needs and specifications.*

➢ ***Steel Roofs:*** *In some parts of the world, metal roofs now account for nearly 50% of all low-rise commercial, industrial and institutional buildings erected during the last several years. Today, in fact, metal roofs, if properly constructed, can lower cooling loads and increase energy savings, hence they are being chosen in many types of commercial constructions. They are the best for electrical generation and are long lasting.*

➢ ***Steel Frames:*** They *can offer durable and sustainable steel solutions with cold-formed steel framing, wide flange structural shapes and joists, and metal building systems.*

➢ ***Structural Steel:*** *Use of steel for structural beams and columns not only adds durability, but is also cost-effective. Architects and designers enjoy the flexibility, high strength, ease of design, sustainability, and aesthetic appeal that it offers.*

Steel used in interiors

- *The use of steel is expanding beyond just exterior applications. Steel is making its way into building interiors and making a bold statement while doing so.*
- *The majority of steel that we see in structures is mild steel and sometimes medium carbon steel. These types of steel are also used for light engineering work such as brackets, table legs, pedestals, furniture frames and wall framing.*
- *Stainless Steel, another form of steel that doesn't require a rust inhibitor or oxidation protection is stainless steel. This is a fantastically versatile material. Stainless Steel is used very extensively for most modern interior furnishings. It has a high tensile strength, allowing it to be applied using hollow tubes, reducing weight and increasing user accessibility.*
- *Kitchen sinks made of high-grade stainless steel meet demanding design, material, functionality and production quality requirements. Cutlery and utensils.*

Mild steel counter top.

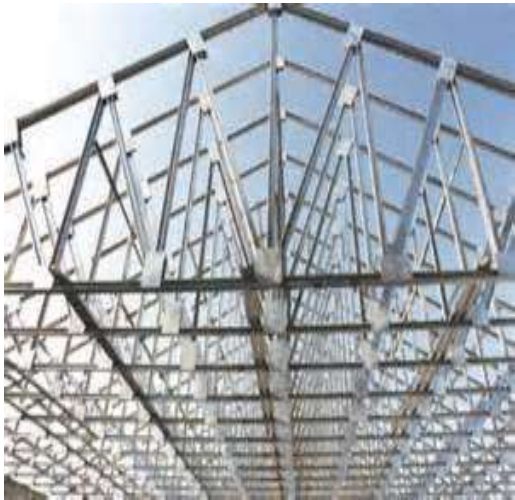
Stainless steel mosaic wall tiles

Stainless steel switch panels

➢Sheet steels in some situations may be perforated to create a patterned effect such as a lattice or they may be textured to form a pattern. An example of this may be tread plate, the steel plate that we see on stairs on industrial sites. These steels and finishes are very important to the interior designer as they can be used to effect in unusual situations. For example a fashion store aiming at the younger market may use tread plate as shelving for the clothing.

➢Liner panels enhance appearance, giving the interior a more finished look. They also protect the insulation. They are an extremely low maintenance product, and will keep your interior looking great for many years to come. They are a fantastic product for any commercial, industrial or institutional project.

➢Metal helped achieve the firm's aesthetic and sustainability goals. Columns and beams are exposed on the interior to serve as an expression of the building. Steel-stud partition walls in the tenant spaces are unfinished at the edges to reveal the structure behind the drywall. Many of the practical touches in the office, such as light-fixture supports, electrical conduits and data-distribution channels, also use exposed and unfinished galvanized steel.



ADVANTAGES

- Speed of erection.
- Quality of construction..
- Ease of repair.
- Adaptation of prefabrication.
- Repetitive use.
- Expanding existing structures.

Thermal properties and Fire resistance

- *Properties depend largely on alloying elements.*
- *Carbon is added to iron to make it stronger. Melting point change depending on the amount of carbon present by mass. But once carbon content in 'steel' exceeds 2.1% by mass it is no longer steel and is called Cast Iron.*
- *Steel looses strength when heated sufficiently. There is a critical temperature after which it cannot safely support the load.*

LIMITATIONS OF STEEL

- *Corrosion*
- *Expensive fireproof treatment*
- *Subjected to bulking*
- *Can be more expensive than other materials*

Classic examples of buildings with steel as major construction material.

- *The U.S. Steel Tower is the tallest skyscraper in Pittsburg and the 37th tallest in United States. The 64-story tower was finished in 1970 and is 256 meters high.*
- *The Steel Tower truly stands apart, due to its unique triangular shape with intended corners.*
- *The main frame is made out of steel, also displayed on the exterior of the building throughout huge Corten steel columns that resist the corrosive effects of all the weather conditions.*
- *The tower has over 40,000 metric tons of structural steel and 214,000 square meters of leasable office space. On clear sunny days, the Steel Tower is visible from as far as 80 km.*
- *Abramovich and Frittz were the chief were the architects.*

U.S STEEL TOWER

➢*New York City's Seagram Buildings was built in 1957 and is a fine example of modern and functionalist architecture. The steel frame used for the construction of Seagram Building needed to be covered in concrete, to comply the federal regulations, although the architects would have preferred to be visible. Non-structural glass walls with three-position windows blinds were hung from the frame.*

➢*Ludwig Mies van de Rohe, was the main architect of this steel wonder. At the moment of its completion, this 38 storey building was one of the most expensive sky scrapers ever built.*

SEAGRAM BUILDING

EIFFEL TOWER

➢*The Tower derives its structure from the pylon supports for the earlier bridges but at a much greater scale.*
➢*The four pylons curve up from their separate bases in three stages to meet at the top at the point where they are about to become straight.*
➢*At each stage the pylons are joined horizontally to provide intermediate platforms. Decorative arches which are not structurally required are used at the first stage to temper the heavy horizontality of the girders that connect the four pylons together*
➢*The tapering structural form of the Eiffel tower recognizes and reflects the importance that the horizontal loadings from the wind have on tall buildings.*

EMPIRE STATE BUILDING

➢*Often referred to as one of the seven wonders of modern architecture, this amazing tower continues to be the tallest skyscraper in NYC and the third tallest in USA.*
➢*The 80 years old structure is currently undergoing a massive $550 million renovation that will transform it in one of the most eco-friendly towers in the States. It displays a superb Art Deco design, with modernistic stainless steel canopies on two of the entries and glass enclosed bridges on the second-floor level.*
➢*This 102-story high skyscraper is probably one of the most famous landmarks in New York City.*

WALT DISNEY CONCERT HALL

- *It was opened in October 2003.*
- *Designed by Frank Gehry,*

Apart from its unforgettable exterior look, the Walt Disney Concert Hall is also praised for its acoustics, considered to be one of the best in the whole world

- *Most of the buildings'exterior is designed in stainless steel with a matte finish.*

- *The Gateway Arch, also known as The Gate to the West is a massive monument in the Jefferson National Expansion Memorial in St. Louis.*
- *It is 192 meters wide at the base and reaches a height of 192 meters.*
- *This is the tallest monument ever made in the United States*
- *The Arch symbolizes the extension of United States towards West and was completed in October 1965.*
- *900 tons of stainless steel were used for its construction.*
- *The arch sways up to 45 cm in conditions of high wind, but in regular weather the usually sway is*

GATEWAY ARCH

SEARS TOWER

- *Built in the year 1971 and has 110 floors which makes the total height of the building 4423 m.*
- *Designed by Bruce Graham and Fazlur Rahman Khan.*
- *Materials used were structural steel, black anodized aluminum, bronze-tinted glass.*
- *Highest building in the world 1974-1997.It has 103 elevators.*

74000 tons of steel were used for the construction.

- *Entire structure is of steel frame and glass.*

THE NEW YORK TIMES BUILDING

- *This is the headquarters of the New York Times Company, the publishing house for The New York Time, The Boston Globe and the International Herald Tribune. The height from street to roof is 228 meters ,while the exterior decorative steel wall rises up to 256 meters.*
- *This steel-framed building has ceramic rods mounted on the exterior of the glass curtain on the west, east and south façade, a great feature for the increased efficiency of the building.*
- *In fact, this is considered to be a green structure ever since its construction period, since 95% of the structural steel used here was recycled*

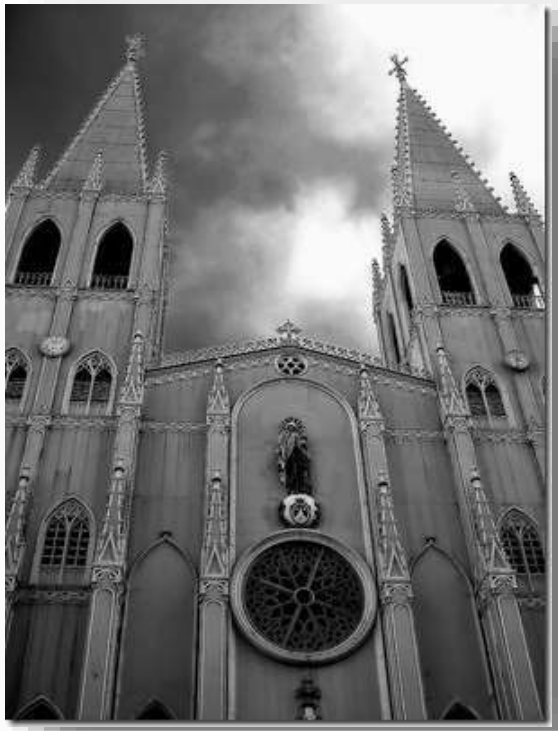
BEIJING NATION STADIUM

- *The stadium has two independent structures, a red concrete seating bowl and the outer steel frame around it at a 50ft distance.*
- *The structure made of steel is actually the result of a complex geometry, based on a main structure of 24 pillars.*

SYDNEY HARBOR BRIDGE

- *This arch bridge in Sydney carries rail, car, bike and pedestrian traffic from Sydney Central Business District to the North Shore and backward for 1,149 m .The locals nicknamed the bridge "The Coat Hanger", due to its main piece of design, the arch.*
- *The Sydney Harbour Bridge currently holds two world records: it is the widest long-span bridge and the tallest steel arch bridge, being 130 meters above the water level.*
- *The amazing arch spans over 503 meters and on hot days the structure can expand in height with more than 18 cm*

BASILICA OF ST. SABASTIAN



- *Basilica of St Sebastian is the only all-steel church in Asia .*
- *Completed in 1891, the basilica is constructed in the Gothic style and is considered to be one of the best examples of this architectural type in the Philippines.*
- *The pre-fabricated steel sections of the church were connected, the walls were filled with mixed sand, gravel and cement.*
- *Although the popular culture mentions Gustave Eiffel as one of the architects of this Basilica, there are no records to prove this. The only known architect of Basilica of San Sebastian is Genaro Palacios.*

INLAND STEEL BUILDING

- *The Inland Steel Building in Chicago was one of the most innovative structures of its time. The project was completed in 1957 and was the first building to be erected on a steel piling.*
- *It is also the first to have in-built air conditioning and to use the principle of clear-span construction, which means that the entire weight of the building is supported by 7 external columns.*
- *The Building is covered by a flat stainless steel curtain and currently is undergoing a major restructuration that will update all its features.*
- *It is one of the best examples of a style in architecture that followed the "form follows function" standard.*