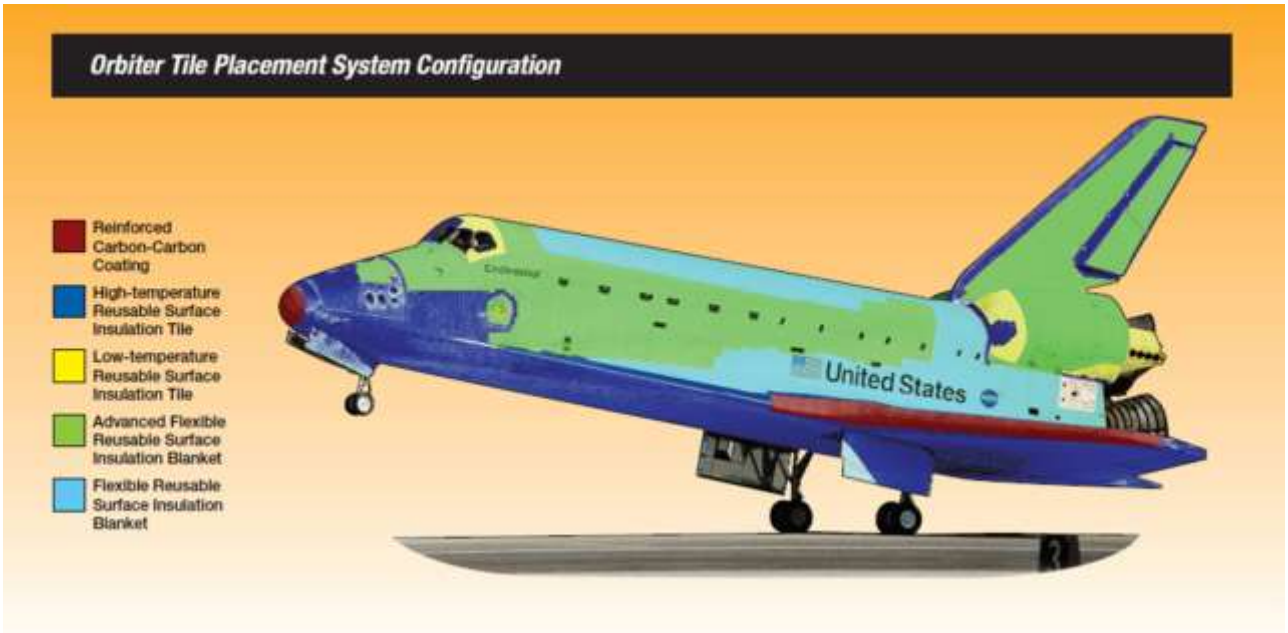
Thermal protection systems

During re-entry, the temperature of a shuttle can reach up to 1648°C. The shuttle is covered in multiple materials on its outer skeleton to allow the astronauts to maintain the shuttles temperature whilst in the Re-entry phase. These materials are reusable for 100 missions and can cope with the cold outer space (-157°C) and the re-entry phase. The materials have to be tight on to decrease the overall temperature (from friction). There are many tests to see what happens under different circumstances.



Flexible Reusable Surface Insulation

White blankets made of coated Nomex ©Felt Reusable Surface Insulation protected areas where surface temperatures fell below 371°C. The blankets were used on the upper payload bay doors, portions of the mid-fuselage, and on the aft fuselage sides.

Tiles

The background to the shuttle's tiles lay in work dating to the early 1960s at Lockheed Missiles & Space Company. It is reusable insulation made of ceramic fibres for use as a re-entry vehicle heat shield. NASA used two categories of Thermal Protection System tiles on the Orbiter—low- and high temperature.

Each shuttle was covered by more than 24,000 of the six- by six-inch blocks. Most of the tiles are made of silica fibres, which is an excellent insulator because it transports heat slowly. When the outer portion of a tile gets hot, the heat takes a long time to work its way down through the rest of the tile to the shuttle's skin. The tiles keep the orbiter's aluminium skin at 180°C.

The tiles are exposed to reentry temperatures of up to 1,300°C , such as the underside, are given a protective coating of black glass. Black tiles work by reflecting about 90 percent of the heat they're exposed to back into the atmosphere, while the tiles' interior absorbs the rest. The tiles' interiors radiate absorbed heat so slowly that after landing, the tiles take hours to cool.

On parts of the shuttle's upper fuselage, which are exposed to much lower temperatures, the tiles are covered with a whitewash of silica compounds and aluminium oxide; these tiles protect against temperatures of up to 650°C.

http://www.airspacemag.com/how-things-work/shuttle-tiles-12580671/#fo82U8FYfJLRzS5M.99