**Real World Materials used for Spacecraft**

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| **CORE Material** | **Titanium**  **#1** | **Steel**  **#2** | **Aluminum**  **#3** | **Insulation Blankets #4** | **Composite materials**  **#5** |
| **Material Properties** | * Lightweight; Lighter than steel; Heavier than aluminum * Strong * Not as corrosive as aluminum and steel. * Holds strength at high temperatures | * Heavy; 3X heavier than aluminum * 4X Stronger than aluminum; 3X stiffer than aluminum * Holds strength at high temperatures better than aluminum | * Lightweight * Strong * Not as corrosive as other steel * Loses strength at high temperatures (i.e think if this is good/bad for re-entering the earth’s atmosphere) | * Thermal protection * Reflective * Electric insulator | * Depends on Composite type:   + Polymer   + Metal   + Carbon * High tensile strength (stiff) * function in high temperature |
| **Application** | Used for many modern air structures | Landing gears | Used for many flight structures; Allowed to be used for space crafts with little to no requirements for high performance or light weight | Launch vehicles  Multiple spacecrafts and satellites  Instruments in vacuum | Used for many modern air structures |
| **Cost** | Expensive | Expensive | Cheaper than Composites | Affordable | Varies |
| **Class Material Equivalent** | Aluminum Foil | Cardboard | Aluminum Foil | Space Blanket | Plastic page protector, Foam Core, Construction Paper |
| **Image** | Image result for titanium material | Image result for steel material | Image result for steel material | Image result for aluminized mylar film | Image result for composite materials |

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| **Supplemental Material** | **Thermal Protection**  **#6** | **Additional Structural supports**  **#7** | **Capture Mechanisms**  **#8** | **Tools (Free)**  **#9** |
| **Material Properties** | * Flexible * Reusable * Lightweight * Holds strength at high temperatures | * Strong * Not as corrosive as other steel * Lightweight | * Tethers and nets * magnets * lasers * adhesives | * Lightweight * Strong * Not as corrosive as other steel * Loses strength at high temperatures (i.e think if this is good/bad for re-entering the earth’s atmosphere) |
| **Application** | Used for many modern air structures, especially those required to re-enter atmosphere at high speeds | This material re-enforces the structural integrity of the spacecraft | These materials gather or collect the space junk | These are the key tools that will be a provided resource in constructing your spacecraft; |
| **Cost** | Cheaper than metal | Affordable | Moderate | Free |
| **Class Material Equivalent** | Index Cards, foam core board | Pipe cleaners, coffee stirrers, paper clips, straws | Magnets, string, mesh/netting | Scissors, rulers, pencils, masking tape, glue |
| **Image** | https://upload.wikimedia.org/wikipedia/commons/thumb/0/05/Space_Shuttle_Endeavour_at_California_Science_Center_%288143982281%29.jpg/1024px-Space_Shuttle_Endeavour_at_California_Science_Center_%288143982281%29.jpg |  |  | Image result for nasa space tools |

**Resources:**

<https://www.nap.edu/read/2351/chapter/7#48>

[http://hpf.psu.edu/2014/09/29/mli-blankets/ https://www.nap.edu/read/2351/chapter/7#47](http://hpf.psu.edu/2014/09/29/mli-blankets/)

<https://www.nasa.gov/centers/johnson/pdf/584733main_Wings-ch4g-pgs270-285.pdf>

<https://www.nasa.gov/vision/space/gettingtospace/16sep_rightstuff.html>