MATERIAL PROPERTIES COMPARISON CHART: Ultralightweight Manual Wheelchairs

ALUMINUM ALLOYS	CARBON FIBER	TITANIUM
Lowest strength to weight ratio	Highest strength to weight ratio	Good strength to weight ratio
Isotropic material (properties are not direction dependent) • Material properties remain the same in all directions • To increase durability, may sacrifice on weight due to increased thickness of material in areas of wheelchair that withstand more forces	Anisotropic material (properties are direction dependent) • Fibers can be organized in different directions • Fibers organized depending on forces present in that area • increases durability and keeps product as light as possible	Isotropic material (properties are not direction dependent) • Material properties remain the same in all directions • To increase durability, may sacrifice on weight due to increased thickness of material in areas of wheelchair that withstand more forces
Poor fatigue life	Capable of infinite fatigue life Durable and long lasting	Good fatigue life Durable and long lasting
Easier to access & manufacture • Welding, hydroforming, tube manipulation	Specialized manufacturing techniques/factory required	Specialized manufacturing techniques/welding required
Corrosion resistant	Corrosion resistant	Corrosion resistant
Not impact resistant. If damaged, will not perform the same as it did initially	Not impact resistant. If damaged, looks catastrophic and requires professional repairs	Impact resistant. If damaged, will not perform the same as it did initially
Lower raw material cost/more cost-effective compared to carbon fiber and titanium	More costly than aluminum	More costly than aluminum
Typically funded in more markets with clinical justification	Not typically funded unless specific clinical justification provided	Not typically funded unless specific clinical justification provided
Common alloys in our industry • Alloys indicate different mixtures of elements in the material • Different alloys alter the characteristics of the metal, durability, flexibility, etc.	Can build in flexibility and rigidity	More rigid than carbon fiber
Inherently does not possess vibration damping properties	Vibration damping – Dissipates energy quickly, smoother ride, e.g. If one side of the frame is vibrating, it won't reach the other side	Inherently does not possess vibration damping properties
	Molded into elaborate/functional shapes	
	Heat/cold resistance (low thermal expansion)	