

OWEN EVANS.

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MATERIALS AND INTRODUCTION TO PROCESSING

TECHNICAL CERAMICS WOULD NOT BE CONSIDERED AS THEY ARE TOO BRITTLE AND WOULD FRACTURE UNDER IMPACT. MANUFACTURING COSTS WOULD ALSO BE HIGH. USUALLY RESTRICTED TO SMALL FORM PRODUCTS.

C. BOTH MATERIALS PROVIDE A GOOD STRENGTH TO WEIGHT RATIO, WITH COMPOSITES OUTPERFORMING STEEL. COMPOSITES ARE MORE EXPENSIVE TO MANUFACTURE AND ANY FIXING/JOINING SYSTEM WOULD REQUIRE THE USE OF OTHER MATERIALS EMBEDDED IN THE COMPOSITE AS THE MATERIAL CAN NOT BE THREADED, WELDED OR BRAZED, WHEREAS STEEL CAN. THIS ADDS EXTRA COST, PROCESSES AND EXPANDS THE BILL OF MATERIALS FOR COMPOSITE BUILDS. COMPOSITE IS UNRELIABLE, WHEREAS STEEL IS, MEANING THE ENVIRONMENTAL IMPACT OF

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THIS IS DUE TO THE MATERIAL COOLING AT A DIFFERENT RATE TO THE RATE IT WAS ORIGINALLY COOLED. THE MATERIAL BECOMES LESS DUCTILE AND REDUCES THE ABILITY OF THE MATERIAL UNDER FATIGUE SITUATIONS. THIS CAN BE DUE TO THE MATERIAL EXPANDING WHEN HEATED, AND CONTRACTING WHEN COOLED, PLACING AN INTERNAL STRESS ON THE MATERIAL AS IT PULLS ON THE JOIN. THE MATERIAL CAN ALSO BE WEAKENED BY HYDROGEN CRACKING BY INTRODUCING HYDROGEN INTO FERRITIC METAL, LEADING TO EMBRITTLEMENT.

BRAZING IS MORE DESIRABLE AS IT JOINS MATERIALS THROUGH THE MELTING OF A ^{DIFFERENT} METAL AT A LOWER TEMPERATURE OF THAT OF THE PRIMARY METAL

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4a. THE MATERIAL FOR THE CYLINDER MUST BE CAPABLE OF A HIGH FATIGUE LIMIT, WITH HIGH HARDNESS, TOUGHNESS AND YIELD STRENGTH. THIS IS DUE TO THE REPEATED LOADING AND UNLOADING OF PRESSURE, NOT ONLY THE INTERNAL PRESSURE OF THE OXYGEN, BUT ALSO THE COMPRESSIVE EXTERNAL PRESSURE OF THE WATER. IT MUST BE DURABLE

THE MATERIAL MUST NOT DEGRADE WHEN EXPOSED TO SALT WATER CONDITIONS AND SHOULD NOT DEGRADE WITH EXPOSURE TO UV.

THE MATERIAL MUST ALSO BE LIGHTWEIGHT SO AS NOT TO IMPEDE THE MOVEMENT OF THE USER.

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COMPOSITE HAS A MUCH GREATER YIELD STRENGTH TO COPE WITH PRESSURE AT LOWER DEPTHS. IT IS ALSO THE LIGHTEST MATERIAL. THIS WOULD BE THE BEST CHOICE, ALTHOUGH EXPENSIVE.

$$d: t = \frac{2Pd}{\sigma_{\text{yield}}}$$

$$t = \frac{2 \times 70 \times 10^6 \times 0.1}{1850 \times 10^6}$$

$$t = 2.162 \times 10^{-3} \text{ m}$$

for:

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$$W = V \times d$$

$$W = 4.0758 \times 10^{-4} \times 1740$$

$$W = 0.71 \text{ kg} \quad \text{WEIGHT OF CYLINDER}$$

$$W_{\text{TOTAL}} = W + (2 \text{ WEIGHT OF END CAPS})$$

$$W_{\text{TOTAL}} = 0.71 \text{ kg} + (2 \times 1 \text{ kg})$$

$$W_{\text{TOTAL}} = 2.71 \text{ kg.}$$

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1. • NON-TOXIC - AS PRODUCT IS EDIBLE, THE PACKAGING MUST NOT CONTAMINATE THE PRODUCT AND MAKE IT DANGEROUS TO EAT
- DURABLE - PRODUCT TARGET AUDIENCE IS OUTDOORS TYPE, SO MUST BE ABLE TO WITHSTAND IMPACTS
- MALLEABLE - IF CONTAINER IS TO BE SHAPED INTO SHEETS FROM METAL, PROCESS MUST NOT WEAKEN PACKAGE.
- RELIABLE - TARGET AUDIENCE IS ECO-FRIENDLY
- LOW COST - REDUCED MANUFACTURING COSTS

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PLASTIC - CAN BE MANUFACTURED CHEAPLY. IDENTIFICATION OF PRODUCT CAN BE APPLIED VIA ADHESIVE LABEL ALLOWING SAME DESIGN OF CONTAINER FOR MULTIPLE PRODUCTS BY CHANGING THE LABEL. MATERIAL IS RECYCLABLE, NON-POROUS. REQUIRES HIGH AMOUNTS OF ENERGY TO MANUFACTURE. MUST BE BPA-FREE PLASTIC. CAN BE REUSED FOR OTHER CONTENTS ONCE PACKAGE IS EMPTY

GLASS - CAN BE MANUFACTURED CHEAPLY. IDENTIFICATION WITH ADHESIVE LABEL, WIDELY RECYCLABLE. HIGH TENSILE LOAD BUT BRITTLE, BROKEN MATERIAL CAN CAUSE INJURY. NOT SUITABLE TO OUTDOORS ENVIRONMENT

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2a. METALLIC BONDING IS A CHEMICAL BOND CAUSED BY THE ELECTROSTATIC FORCE OF ATTRACTION OF POSITIVELY CHARGED METAL IONS AND AN ELECTRON CLOUD OF DELOCALISED ELECTRONS.



METALS WITH A VALENCY OF 2 ARE STRONGER AS THEY HAVE TWICE THE AMOUNT OF ELECTROSTATIC FORCE HOLDING THE MATERIAL TOGETHER

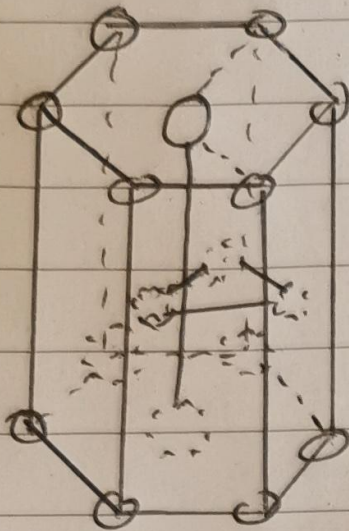
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HCP



TOP AND BOTTOM PLANE OF 7
ATOMS FORMING A REGULAR HEXAGON
AROUND A CENTRAL ATOM

c. $BCC = 0.68$

$HCP = 0.74$

d. THE MIXTURE IS A TITANIUM NICKEL LIQUID SOLUTION

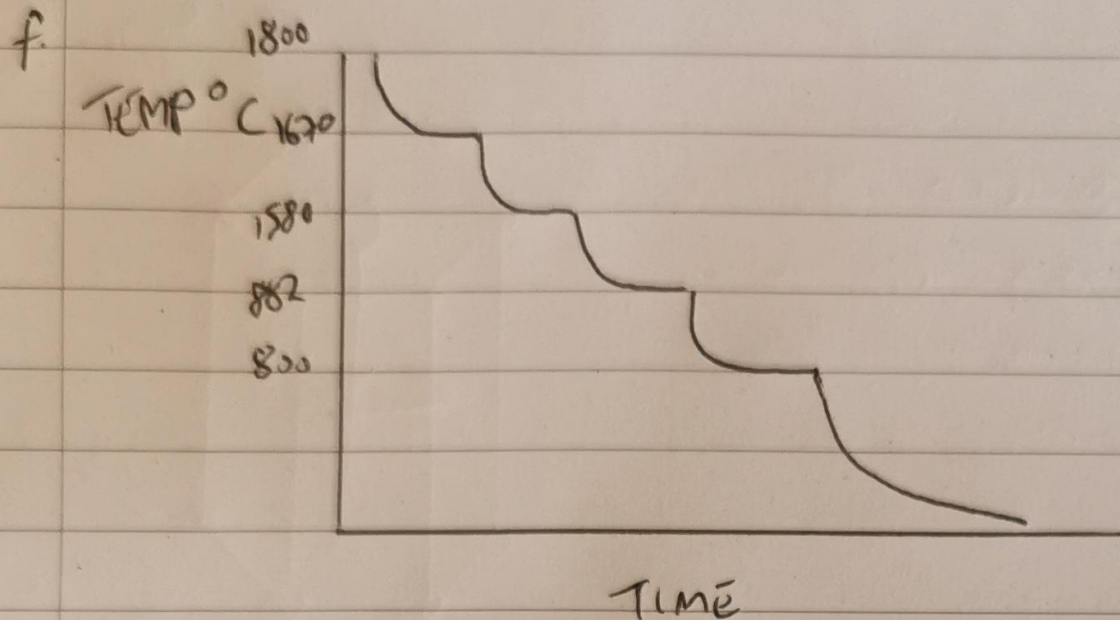
e. $1153^{\circ}C$ - MATERIAL BECOMES A COMPOUND OF THE TITANIUM

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3a. A RACING CAR CHASSIS MUST BE STRONG AND LIGHTWEIGHT. TO ACHIEVE THIS, THE MATERIAL CLASSES ARE REQUIRED TO BE IN THE UPPER RIGHT HAND QUADRANT, AS THE OTHER QUADRANTS WILL NOT PROVIDE ENOUGH STRENGTH FOR THIS