

07 年材料学院硕士研究生入学面试试题（金属材料）

Test Questions for candidate of Master graduate student
of Material College 2007 (Metallic Material)

一、 金相组织中相和组织有何区别？

what is the difference between phase and microstructure in
Metallography of metallic material?

答：相是指金相组织中均匀的、性质相同的、有界面分开的那一部分，
组织则是与相或相和相的形状、大小、分布有关。

Answer: The phase is referred to a homogeneous, identical part
separated by interface or boundary. Microstructure is related
to the shape, size and distribution of phases.

二、 金属中的中间相和固溶体在力学性能上有何不同，请解释之。

what is the difference of mechanical properties of intermediate
phase and solid solution? Explain the reason, please.

答：金属中的中间相和固溶体相比，硬度高，抗高温蠕变能力强，但
脆性大。原因是固溶体取纯金属组元溶剂的结构，为结构致密的金属
键晶体；中间相则与其纯金属组元的结构不同，且结构中除金属键还
存在共价键，所以中间相具有硬度高，抗高温蠕变能力强，脆性大的
特点。

Answer: Compared with solid solution, the intermediate phase
has high hardness, high resistance to high-temperature creep
and high brittleness. The reason is that the crystal lattice

of solid solution is the same as solvent and exist metal bond;
On the other hand, the crystal lattice of intermediate phase
is different from that of pure metallic component. Besides
metal bond, covalent bond also exists. As a result, the
intermediate
phase has the characteristics of high hardness, high resistance
to high-temperature creep and high brittleness.

三、 金属材料的加工硬化现象对金属材料的力学性能有何影响?

what is the effect of work hardening phenomenon on metallic
material?

答: 加工硬化使金属材料变形均匀、强度大、脆性大。

Answer: After work hardening, the hardness, strength and
brittleness of metallic material will be increased; the plastic
deformation of metallic material concerned will be progressed
more uniformly.

四、 在三大材料金属材料、高分子材料、无机非金属材料中, 金属
材料的那一项力学性能最具优势?

among the mechanical properties of metallic material (such as
strength, hardness, ductility and toughness etc.), which one
is the best when compared with polymeric material and inorganic
material?

答: 金属材料的韧性最高。

Answer: The toughness of metallic material is the best.

五、 请指出低碳钢、中碳钢和高碳钢的碳含量范围，指出一些它们应用的实例。

Point out the range of carbon content of low-carbon steel, medium-carbon steel and high-carbon steel. Give some examples for their applications.

答：低碳钢、中碳钢和高碳钢的碳含量范围分别是 $<0.25\%C$ 、 $0.25\text{—}0.60\%C$ 、 $>0.60\%C$ 。低碳钢适于制造大型的结构件，例如桥梁；中碳钢适于制造机器的结构另部件，例如轴和齿；高碳钢可用于耐磨件的制造，例如锉刀和钻头。

Answer: The range of carbon content of low-carbon steel, medium-carbon steel and high-carbon steel is $<0.25\%C$, $0.25\text{--}0.60\%C$ and $0.60\%C$ respectively. Low-carbon steel is suitable for making steel structure, such as bridge; most parts of machine, such as shaft, teeth, are made of medium-carbon steel; high-carbon steel is used for parts with high wear resistance such as file, drill etc..

六、 片状珠光体和粒状珠光体在性能上有何差异，如何使片状珠光体变成粒状珠光体。

Assume a carbon steel containing lamellar pearlite and another one containing nodular pearlite, what is the difference for the

mechanical properties of them? How to transform the lamellar pearlite into nodular pearlite?

答：一般地，片状珠光体的强度高于粒状珠光体、塑性低于球状珠光体。球化退火可使片状珠光体变成球状珠光体。

In general, the strength of carbon steel containing lamellar pearlite is higher than that of carbon steel containing nodular pearlite, but the ductility of the former is lower than that of latter. By spheroidizing, the lamellar pearlite can be transformed into nodular pearlite.

七、提高铝合金的强度的主要途径是什么？

what are the main ways to increase the strength of aluminum alloy?

答：时效强化和形变强化。

Using Ageing strengthening and strain strengthening, the strength of aluminum alloy can be increased.

八、提高铁碳合金强度的主要途径是什么？

what are the main ways to increase the strength of Fe-C alloy?

答：固溶强化、相变强化、细化强化、形变强化。

Solid solution strengthening, (hardening), Phase transformation strengthening, Dispersion strengthening and strain strengthening can be used to increase its strength.

九、一高碳钢的金相组织中 Fe_3C_{II} 沿晶界分布，如何消除这一组织缺

陷？

Assume Fe_3C_{II} was distributed along with the grain boundaries of high-carbon steel. How to eliminate the harmful microstructure?

答：正火。

Answer: Normalizing should be carried out to eliminate the harmful microstructure.

十、 金属的铸造组织和锻造组织有何不同？铸件和锻件的性能有何差异？

what is the difference of microstructure and mechanical properties for castings and forgings?

答：一般地，铸造组织为树枝晶组织，组织成分不均匀；锻造组织的组织成分较为均匀。锻件的强度、塑性和韧性优于铸件。

In general, dendrites occur in the microstructure of castings and the distribution of chemical elements is not homogeneous. On the other hand, the distribution of chemical elements in forgings is more homogeneous. The strength and ductility of forgings are better than that of castings.