

## Examiners' Report - Paper A 2007 (Chemistry)

### Background:

The paper concerned alloys of AB<sub>2</sub>-type with Ti and/or Zr as the A-component (formula Ti<sub>a</sub>Zr<sub>1-a</sub>M<sub>2</sub>) and containing at least one non-metallic element selected from B, C, N, S and Se, their preparation as well as their use as hydrogen storage materials.

Document 1 also describes the same base alloys for hydrogen storage but without the incorporation of the non-metallic elements and only for the alloys having a B component selected from Mn, Cr, V, Fe, Co and Mo.

The applicant's letter stated that the known alloys were difficult to activate, that they had a low absorption-desorption velocity and that they had a relatively small hydrogen storage capacity. It further stated that hysteresis was a problem and that the absorption curve was steep for these materials.

Most of these problems were overcome by the addition of the above non-metallic elements in an amount of 0.01 to 5 atomic %. The letter of the applicant further made it clear that the improvement of the properties was not limited to alloys having the B component as in document 1.

A further, new problem that was stated to arise from the incorporation of the non-metallic elements was that cracks formed in the alloy due to expansion and shrinkage during their use that made them unusable for hydrogen storage. The solution to this additional problem was to form fine particles of the alloy giving the useful hydrogen storage properties.

### Independent claims:

The candidates were expected to draft an independent product claim of the following scope:

AB<sub>2</sub>-type alloy with Ti and/or Zr as the A-component (or using the formula Ti<sub>a</sub>Zr<sub>1-a</sub>M<sub>2</sub>) and containing at least one non-metallic element selected from B, C, N, S and Se in a total amount of from 0.01 to 5 atomic %.

This claim was worth up to 30 points.

Good candidates realised that the alloy as such was a new and useful material (as an intermediate). A limitation to the powder led to the loss of a significant number of the points allocated (up to 25). Those candidates not specifying the essential non-metals had up to 25 points deducted, a significant number (up to 20) of points was also lost by not incorporating the essential amounts of the non-metal. The candidates limiting the alloys to specific metals (B-component) lost half of the available points. The definition as a composition comprising the alloy would lead to a minor reduction of points due to lack of clarity. The indication of the use (for) or definition as hydrogen storage material of the alloy led to more reduction since the claim should be drafted with the broadest scope possible. Product-by-process claims were not appropriate and such a mistake also led to a loss of up to 15 points. The definition of B in the formulae as a metal was not expected and no additional points were awarded for this.

The candidates were also expected to draft independent process claims directed to the preparation of both the intermediate alloy and the powder of following scope:

A process/method for making the alloys as defined above from the elements by melting them in a protective atmosphere.

A process/method for making powder or particles (particle size  $<100$  nm), by first preparing the alloy and then forming the powder (or use of the alloy for preparing the powder/hydrogen storage material).

These claims were awarded 5 points each.

Here, missing essential features such as not melting in protective atmosphere led to loss of all the points. Unnecessary limitations, such as the definition of specific furnace or specific protective atmosphere resulted in a proportional reduction or the limitation to preparation of particles by vaporization/deposition resulted in deductions of up to 2 points each.

The candidates were further expected to draft an independent use claim directed to the use of the alloy powder as was indicated by the letter to be the only useful form for the purpose of storing hydrogen which also attracted a high number of points, 20 in total of the following scope:

Use of the alloy powder (or particles), having the diameter  $<100$  nm for storing hydrogen.

Significant numbers of points were lost for claims to the use of a range of materials broader than was appropriate to the use. Any essential feature missing/unnecessary limitation led to reduction of up to 3/4 of the points, failing to mention particle size, not specifying the non-metal or its essential amount or the limitation to specific B-component.

In the German version of this paper the alloy was stated to be “**nahezu** unbrauchbar” that is “almost useless” for storing hydrogen, whereas in the English and French versions of the paper the alloy was stated to be useless. This discrepancy was taken into account during the marking.

A number of candidates included additional unnecessary independent product or use claims in addition to those specified above, contrary to Rule 29(2) EPC or included further clearly invalid independent claims. Up to 10 points could be deducted from the total number of marks available for the product or the use claims in these situations.

60 points in total were available for the independent claims.

### Dependent claims:

Perfectly drafted dependent claims could attract a significant number of points, 25 points total.

Suitable dependent claims included claims directed to the alloy having the B (metal component) selected from the group consisting of Mn, Cr, Fe, V, Co and Mo (gained up to 5 points) and to the preferred amounts of the non-metal (up to 2 points). Further dependent claims that were expected were directed to the alloy of the main claim in form of the powder/particles with defined essential particle size (up to 5 points) and to the preferred particle sizes (up to 4 points).

Suitable dependent process claims included claims requiring that the non-metallic elements were added in the form of a compound of one of the metals and the non-metallic element (up to 5 points) and that the particles were formed by subjecting the alloy to vaporization-deposition (up to 4 points).

Most candidates filed a reasonable number of claims, a "shot-gun approach" or drafting additional unnecessary claims were neither helpful nor well-received by the examiners. It was regarded as a sign of weakness and only led to the loss of valuable time that could be used more efficiently to the essential parts.

### Description:

The candidates were expected to provide a description comprising a due support for the claims. A summary of the only document cited and the problems solved in view of the prior art were also expected to be included. Also the description was expected to be suitably modified in order to be in good form. 15 points were available for the description.

Divisional applications were not necessary, nor expected.

# EXAMINATION COMMITTEE I

Candidate No. \_\_\_\_\_

## Paper A (Chemistry) 2007 - Schedule of marks

Category	Maximum possible	Marks awarded	
		Marker	Marker
Product claims	30		
Process for making alloy	5		
Process for making powder	5		
Use claims	20		
<b>Independent claims</b>	<b>60</b>		
<b>Dependent claims</b>	<b>25</b>		
<b>Description</b>	<b>15</b>		
<b>Total</b>	<b>100</b>		

Sub-Committee for Chemistry agrees on ..... marks and recommends the following grade to the Examination Board:

PASS  
(50-100)

FAIL  
(0-49)  
COMPENSABLE FAIL  
(45-49, in case the candidate sits  
the examination for the first time)

6 July 2007