

Examiners' Report Paper B 2012 (Chemistry)

1. Introduction

The paper relates to an industrial process for the production of vinyl cyanide and acetonitrile. The application as filed claims a process in which propylene, ammonia and an oxygen-containing gas are reacted at 200-350°C. According to the application the use of a copper (II) catalyst rather than the iron (III) catalysts used previously results in significant amounts of acetonitrile being produced. In addition the use of the copper (II) catalyst results in a higher yield of the desired products vinyl cyanide and acetonitrile. The examples in the application provide evidence for this effect. The application also claims an apparatus for use in this process.

Document 1 (a previous application from the same applicant) discloses the same process and apparatus (claims 1-4 of document 1 define the same process and apparatus defined in claims 1-4 of the application). It was not however recognised in document 1 that acetonitrile was formed (a by-product was noted but had not been identified).

Document 2 discloses the process claimed in the application and demonstrates that acetonitrile is formed. Furthermore both document 1 and document 2 disclose that acetic acid is produced as a by-product.

The applicant stated that in the US a patent was granted on the corresponding application, without any amendments having to be made to the claims. The paper simulates real-life situations where the applicant obtains protection in his home jurisdiction and assumes, wrongly, that all other jurisdictions have the same law and practice. In the present case the applicant indicates that document 1 should not be regarded as prior art as the applicant and inventors are the same as in the application. The applicant also indicates that document 2 should not be regarded as prior art as the inventor of the application performed the invention prior to the experiments in document 2 being performed. According to the EPC these documents are however prior art and thus the claims need to be amended.

2. Claims (40 Marks)

The expected amendment to the independent process claim is to require that at least 1-30 carbon mol% of acetic or formic acid is added to the reactants before they contact the catalyst bed. This addition has the effect of further increasing the amount of acetonitrile produced as well as the yield of vinyl cyanide and acetonitrile (as shown in table 1). The application in paragraph [005] refers in general to carboxylic acids solving this problem, but in paragraph [008] it is stated that the carboxylic acid must be acetic acid or formic acid. The results presented in the example (run number 8) show that if propionic acid is used the concentration of vinyl cyanide and acetonitrile in the product is reduced to below the minimum acceptable concentration of 80 carbon mol%. and thus the claim has to be limited to the use of formic or acetic acid. The concentration range of 1-30 carbon mol% is stated to be essential in paragraph [005]. The process claim is worth 20 marks.

An alternative acceptable claim would be a claim to the use of 1-30 carbon mol.% of acetic or formic acid in a process as defined in original claim 1 to increase the amount of acetonitrile produced.

10 marks are deducted if the claim is limited to recycled acetic acid, limiting to acetic acid or to any carboxylic acid results in a deduction of 5 marks. Limiting the process to the use of formic acid results in a deduction of 15 marks as such a claim is contrary to the applicant's instructions. The applicant indicates in the letter that using recycled acetic acid is preferred, but there is no need to exclude other useful and inventive embodiments. Limiting the amount of acid to 1-15 carbon mol.% or failing to specify an acid concentration results in a deduction of 7 marks each. It is not necessary to specify that the product contains at least 80 carbon mol. % of acetonitrile and vinyl cyanide and such a limitation resulted in a deduction of 7 marks. Other unnecessary limitations to the claims (for example using an aqueous solution of acid or catalyst in powder or granular form) also result in a deduction of 7 marks each. Sets of claims which contravene Rule 43(2) EPC lose 5 marks. 8 marks are deducted if the amendments contravene Article 123 (2) EPC. A claim to a process comprising "contacting" a mixture containing propylene, ammonia, an oxygen-containing gas and 1-30 carbon mol. % of acetic acid or formic acid with the catalyst could be awarded a maximum of 5 marks. The tables in document 2 show that in a catalyst bed the reactants propylene, ammonia and oxygen as well as the acetic acid formed as a by product are all contacted with the catalyst.

The independent apparatus claim has to be amended by specifying that it contains a conduit (9) by means of which acetic acid can be recycled from the spray tower to the reaction bed (see paragraph [013]). This has the advantage that the yield of acetonitrile can be increased whilst minimising the significant costs associated with purchasing large quantities of carboxylic acids (see the applicant's letter). This claim is worth 14 marks.

Claims which define this conduit only in process terms are unclear and lose 6 marks. Other issues such as lack of clarity or adding further unnecessary process features result in the deduction of 2 marks each. Added subject-matter results in a loss of 7 marks. It is important in this paper to formulate the amendment to the apparatus claim with wording corresponding as closely possible to the disclosure of the final sentence of paragraph [013]. Failing to specify that the conduit links the spray tower and the reaction bed for example resulted in a claim which contained added subject-matter. Apparatus claims which are supposed to differ from the apparatus disclosed in document 1 by the presence of a conduit (10) for adding carboxylic acid are not novel and receive no marks. Document 1 in paragraph [010] discloses an additional conduit for supplying inert gas. An apparatus with a conduit for adding carboxylic acid would only be novel with respect to an apparatus with a conduit for supplying inert gas if the intended use implies differences in the conduits. There is nothing in the paper to suggest that the conduits are different and thus no convincing argument for the novelty of an apparatus claim with a conduit (10). It is important to consider when drafting claims containing multiple options whether each option is patentable. Claims to an "apparatus comprising either conduit (9) for recycling acetic acid or conduit (10) for adding carboxylic acid" are not novel and receive no marks.

The remaining marks for the claims are awarded for maintaining claims 2 and 3 (2 marks), and for drafting new dependent process claims. The new dependent claims relate to preferred processes involving the addition of carboxylic acid (the amendment in the independent process claim) and relate to recycling the acetic acid (2 marks) and an acid concentration of 1-15 carbon mol % (2 marks). No marks are awarded or deducted for other claims. In Paper B it is not expected that a large number of new claims should be drafted.

3. Arguments (60 marks)

The arguments are assessed separately from the claims in the sense that candidates who present very good arguments for the claims they have filed can still receive good marks even if their claims receive few marks.

A full basis has to be provided for all of the amendments. This is worth 8 marks. In order to obtain full marks it is necessary to identify the amendments made, identify the passages in the original application which form the basis for the amendments. In addition if features have been combined from different parts of the application or the wording used in the application is modified it is necessary to argue why the amendment has a basis. The examples and/or figures are usually not the most appropriate basis for amendments, as it is rarely possible to argue that individual features in an example or figure are disclosed independently from the other features of the example or figure.

The novelty of the claims also has to be discussed (16 marks). 4 marks are reserved for summarising documents 1 and 2. The summary of the documents should mention those process and apparatus features relevant for novelty and inventive step. It is equally acceptable to provide a separate summary or to summarise these documents as part of the novelty or inventive step arguments. 8 marks are awarded for the novelty discussion of the process claim. In order to obtain full marks it is necessary to highlight the fact that acetic acid is produced in the processes of documents 1 and 2, but that it is not added to the reactants before they contact the catalyst bed. Candidates relying on the use of recycled acetic acid also need to carefully explain why recycled acetic acid differs from the acetic formed in the processes disclosed in 1 and 2. Arguing that no acetonitrile is produced in document 1 is not worth any marks (run 2 in document 1 and run 3 in the application are identical thus demonstrating that acetonitrile although not identified in document 1 is produced in both documents). 4 Marks are reserved for the apparatus claim.

36 marks are available for the inventive step discussion. The process claims (20 marks) and the apparatus claims (16 marks) need to be discussed separately.

Documents 1 and 2 disclose essentially the same process and thus either one of them can be selected as the closest state of the art for the process claim (3 marks). Marks are awarded for identifying either document 1 (on the basis that it discloses an industrial process) or document 2 (on the basis that only this document explicitly mentions that acetonitrile is formed) as the closest prior art, full marks are only available for candidates that provide a good reason for their choice.

The difference has to be identified and the problem has to be defined. One possible definition of the problem is providing a process which enables the amount of acetonitrile in the product to be increased and varied whilst maintaining a high yield of vinyl cyanide (5 marks). The evidence for the solution has to be discussed with reference to the table in the application. Full marks are only available for candidates who analyse the data in detail by comparing the examples of the invention 4-7 with example 3 and 8 to show that this problem is solved. (6 marks).

The obviousness also needs to be discussed (6 marks). The marks under this heading are awarded for providing arguments as to why documents 1 and 2 both individually and in combination do not suggest the claimed subject-matter. It notably should be stressed that in document 1 acetic acid is to be disposed of and that neither of the documents provide any hint to measures which could be taken to increase the production of acetonitrile.

The closest prior art for the apparatus is document 1 (2 marks), the difference and the problem (providing an apparatus enabling the amount acetonitrile produced to be increased and varied in a very economical manner) are worth 5 marks, arguing that the problem is solved using the information in the letter is worth 5 marks (for full marks it should be stressed that purchasing carboxylic acids in the large quantities needed for the process is expensive and that the recycling which is shown to be effective in run 7 solves this problem). The discussion of the obviousness is worth 4 marks.

4. Expected claims

1. A process for producing acetonitrile and vinyl cyanide comprising contacting a mixture containing propylene, ammonia and an oxygen-containing gas with a copper (II) catalyst at a temperature of from 200 to 350°C, characterized in that 1-30 carbon mol% of acetic or formic acid is added to the reactants before they contact the catalyst.
2. A process as claimed in claim 1 wherein the oxygen containing-gas is air.
3. A process as claimed in claim 1 or claim 2 wherein the copper (II) catalyst comprises copper (II) chloride or copper (II) nitrate.
4. A process as claimed in claims 1-3 in which the acetic acid is the recycled by-product of the reaction.
5. A process as claimed in claims 1-4 in which 1-15 carbon mol.% of formic or acetic acid is added.
6. Apparatus for producing acetonitrile and vinyl cyanide the apparatus comprising
 - (i) a reactor (3) for holding a reaction bed,
 - (ii) means for heating the reaction bed in the reactor (3),
 - (iii) at least one conduit (1, 2, 10) for inputting reactants to the reactor (3),
 - (iv) a conduit (5) allowing materials to exit the reactor (3) and enter,
 - (v) a spray tower (4) for spraying water onto the material exiting the reactor (3),
 - (vi) a conduit (9) for recycling the acetic acid solution obtained in the spray tower to the reaction bed (3),
 - (vii) a cooling tower (6) for condensing the vinyl cyanide and acetonitrile exiting overhead from the spray tower (4), and
 - (viii) a distillation tower (8) for separating vinyl cyanide and acetonitrile from the condensate obtained in the cooling tower (6).

EXAMINATION COMMITTEE I

Candidate No. _____

Paper B (Chemistry) 2012 - Marking Sheet

Category		Maximum possible	Marks awarded	
Claims	Process	20		
	Apparatus	14		
	Other Claims	6		
Arguments	Amendments	8		
	Novelty	16		
	Inventive Step	36		
Total		100		

Examination Committee I agrees on marks and recommends the following grade to the Examination Board:

PASS
(50-100)

COMPENSABLE FAIL
(45-49)

FAIL
(0-44)

28 June 2012

Chairman of Examination Committee I