

REMARKS

Claims 32-39, 41, 43, 45, 46, and 48-51 are pending in the application. Claims 36, 37, 39, 43, and 50-51 have been withdrawn due to a restriction requirement, however, rejoinder is respectfully requested at such time as a generic linking claim is found in condition for allowance. Claims 32-35, 38, 41, 45, 46, 48 and 49 stand rejected. Reconsideration and allowance of the pending claims is respectfully requested.

Rejections under 35 USC §112(b)

In the Office action, claims 32-35, 38, 40-42, 44-49, and 52 were rejected under 35 USC §112 as being indefinite. Without commenting on the propriety of the rejection, Applicant has amended claim 32 to recite that the dusty compound comprises Ni and Fe, Cu, graphite, Cr, or combinations thereof, that the closed container is in the chamber of the reactor, and, that the pressure in the chamber during electric field generation is greater than 5×10^5 Pa, the chamber contains at least 99% H₂, the initial temperature is between 80 and 200°C, and the electric field is essentially static and is between 20 and 30000 volts/m. Therefore, Applicant respectfully submits that the rejection in regards to claim 32 and its dependent claims has been overcome.

For instance, in the Office Action, the dusty compound was noted as being unclear. However, as discussed, Applicant has amended claim 32 to recite the dusty compound comprises Ni and Fe, Cu, graphite, Cr, or combinations thereof. Therefore, Applicant respectfully submits that the dusty compound is clear.

Further, the Office Action submitted that "outside a closed container" was unclear. However, Applicant respectfully notes that claim 32 recites that a dusty compound is in the chamber and outside of a closed container, and a radioactive

material is in the chamber *and* in the closed container. Therefore, Applicant respectfully submits that it is clear that the closed container is also in the chamber, and therefore forms a closed container inside the chamber. Thus, a compound may be located in the chamber but be outside of the closed container (e.g. the dusty compound), or alternatively may be located both in the chamber and in the closed container (e.g. the radioactive material). Nonetheless, Applicant has amended claim 32 to recite that the closed container is in the chamber of the reactor to further clarify this point, and therefore respectfully submits that the rejection has been overcome.

In the Office Action, the source of thermal energy was submitted as being unclear. However, Applicant respectfully notes that the preamble recites that this method is an *exothermic* transmutation method. For instance, referring to paragraph [0146] of the present specification,

“During the transmutation step, the temperature in the chamber 7 may be around 360° C. Cooling may start at a temperature chosen between 180° C. and 360° C. More generally, cooling starts after the process becomes thermally self-sufficient. The temperature of the dusty compound and of the nuclear waste may be in the range 400-600° C. The temperature of the dusty compound and of the nuclear waste is similar. Hot points may be at higher temperatures, such as 1000° C. or 1400° C., at a microscopic scale. Hot points may create local melting of metal grains of powder. The high thermal conductivity of the dusty compound and of the containers, possibly of the nuclear waste, reduces the size and the duration of the hot points.”

Therefore, Applicant respectfully submits that that the production of thermal energy may be a consequence of the previous steps of the claimed method, which generate a transmutation. Furthermore, referring to paragraph [0107] of the present specification, in a further aspect, the reactor may include one or more electric heaters 17 and 18. Therefore, Applicant respectfully submits that one having skill in the art would certainly be able to understand how to generate thermal energy, as

well as a source of thermal energy based upon the presently pending claims and specification as filed, and respectfully requests withdrawal of the rejection.

Next, the Office Action asserts that it “is unclear whether the transmutation refers to the conversion of the transition metal to another transition metal or refers to the deactivation of the radioactive material.” However, Applicant respectfully notes that the transmutation is a nuclear reaction which transforms two products (a dusty compound and a radioactive material) into two different products. Thus, the transmutation occurs both in the dusty compound and in the radioactive material. Being of different natures (with extremely different atomic numbers) the start of the process is made easier by the activation of the transition metal. In the case of deactivation of “heavy” radioactive materials (Uranium and similar), the transmutations in the materials to be treated begin after a certain latency period, causing, at their start, a noticeable acceleration of the process, while “lighter” radionuclides (Cobalt or similar) trigger the reaction simultaneously with the transition metal. Therefore, Applicant respectfully submits that the transmutation is sufficiently clear, and would be understood by one having skill in the art based upon the specification as filed, and respectfully requests withdrawal of the rejection.

In regards to hydrogen being in contact with both the dusty compound and the radioactive material, Applicant respectfully notes that there is no requirement that the hydrogen is located in only the chamber or only the container. Therefore, the hydrogen can be in contact with both the dusty compound and the radioactive material according to the presently pending claims, and thus, Applicant respectfully submits that claim 32, as originally filed, is clear in regards to the hydrogen, and respectfully requests withdrawal of the rejection.

Finally, the Office Action asserts that the source of emitted protons is unclear. However, while respectfully submitting that no definition is necessary, as one having skill in the art would understand the limitation and method of aiming the protons, and without wishing to be bound by theory, Applicant respectfully notes that, based upon the examples of the present disclosure, the availability of active nucleons is due to the interaction under the claimed conditions between micrometric metal powders and hydrogen. Applicant respectfully points out that the behavior of the process in the presence of heavy radionuclides can easily suggest that the radionuclides, even after a certain time of pushing by the metals drivers, behave like donors of active nucleons. (referring to the present specification as a whole and the examples). Therefore, Applicant respectfully submits that claim 32, and therefore its dependent claims, are clear, and respectfully requests withdrawal of the rejection.

In regards to claim 38, Applicant respectfully submits that the dependency of claim 38 has been amended to be from claim 35, and therefore submits that the rejection has been overcome.

Without commenting on the propriety of the rejection, Applicant has cancelled claim 40.

Additionally, without commenting on the propriety of the rejection, claim 41 has been amended to recite, "stays in the chamber". Therefore, Applicant respectfully submits that claim 41 clearly recites that the hydrogen remains in the chamber, and respectfully requests withdrawal of the rejection.

In regards to claim 46, the Office Action rejects the meaning of "voluntary addition" as unclear. However, Applicant respectfully notes that deuterium (^2H) and the tritium (^3H) are two isotopes of the hydrogen, the main isotope of which being the protium (^1H). In every sample of hydrogen, there are both protium, deuterium and

tritium. In natural hydrogen, protium constitutes the majority of hydrogen while deuterium and tritium are present in small quantities (about one atom of deuterium for 6420 atoms of hydrogen and one atom of tritium for 10^{18} atoms of hydrogen). Thus, the feature "*the hydrogen is deprived of voluntary addition of deuterium and tritium*" means that there are no more deuterium/tritium than the natural proportions of deuterium and tritium in natural hydrogen, by contrast to some compounds that can be used in nuclear reactions such that heavy water. Therefore, Applicant respectfully submits that "voluntary addition" as used is clear, and would be understood by one having skill in the art.

Finally, without commenting on the propriety of the rejection, claim 47 has been cancelled and the feature of the ultrasonic wave has been removed from claims 48 and 49. Therefore, Applicant respectfully submits that the rejections under 35 USC §112 have been overcome, and respectfully requests withdrawal of the rejections.

Objection to the Drawings

In the Office Action, it was asserted that a closed container is not shown in the Figures. However, referring to Figs. 11 and 12, Applicant respectfully notes, as recited in the brief description of the drawings and paragraph [0175], that "FIG. 11 is a schematic view in perspective of the container used in Experiment 4[, and]FIG. 12 is a schematic view in exploded perspective of the container used in Experiment 4." (Present Specification at [0089]-[0090]). Therefore, Applicant respectfully disagrees with the objection, as the closed container, and a cross-section thereof is clearly shown in Figs. 11 and 12, and respectfully requests withdrawal of the rejection.

Rejections under 35 USC §112(a) and Objection to the Specification

In the Office Action, claims 32-35, 38, 40-42, 44-49, and 52 were rejected under 35 USC §112(a), and the specification was objected to, as assertedly lacking enablement. Initially, Applicant respectfully submits that the above explanations and arguments in regards to the rejection under 35 USC §112(b) are also pertinent to enablement. Namely, Applicant respectfully submits that the above explanations and clarifications cut against the Office Action's assertions in regards to enablement, and therefore, respectfully submits that the presently pending claims, and specification, are clearly enabled as filed.

Nonetheless, Applicant notes that under MPEP 2164.04 " A specification disclosure which contains a teaching of the manner and process of making and using an invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented must be taken as being in compliance with the enablement requirement..." Therefore, as the specification clearly teaches a method of exothermic transmutation for at least partially deactivating radioactive material, and also provides multiple working examples of the taught method, Applicant respectfully submits that the present disclosure teaches a process in terms which correspond in scope to those used describing and defining the scope of the claims. Thus, Applicant respectfully submits that the specification and claims should be awarded the presumption of compliance as stated by the MPEP, and further, that the present specification clearly describes, and is thus enabling of, the presently pending claims.

Furthermore, Applicant respectfully submits that there is no requirement to provide a working example of every potential compound to be used. Instead, the MPEP clearly acknowledges in § 2164.02 that "[w]hen considering the factors relating to a determination of non-enablement, if all the other factors point toward

enablement, then *the absence of working examples will not by itself render the invention non-enabled*. In other words, *lack of working examples or lack of evidence that the claimed invention works as described should never be the sole reason for rejecting the claimed invention* on the grounds of lack of enablement.” Similarly, MPEP § 2164.02 clearly states, “the presence of only one working example *should never be the sole reason for rejecting claims as being broader than the enabling disclosure...*” Therefore, as, conversely, the present Specification *contains a detailed description and multiple examples*, Applicant respectfully submits that the Office Action has failed to show, by a *prima facie* case, that the presently pending claims lack enablement, and respectfully requests withdrawal of the rejection.

Rejections under 35 USC §101

In the Office Action claims 32-35, 38, 40-42, 44-49, and 52 stand rejected under 35 USC §101 as assertedly being inoperative and therefore lacking utility. However, initially, Applicant respectfully submit that the rejection in regards to enablement has been fully addressed above, and has been overcome. Therefore, Applicant respectfully submits that the disclosure is clearly not inoperative as shown by the multiple examples, and thus, respectfully submits that the Office Action has failed to show or provide any rational underpinning for the assertion that the disclosure is inoperative. Thus, Applicant respectfully submits that the rejection has been overcome, and respectfully requests withdrawal of the rejection.

Nonetheless, the Office Action asserts that one having skill in the art would doubt the operability of the invention. However, one having skill in the present art would expect a high level of experimentation and also constant advancement, due to the high technical level of the art, of which the skill level is admitted in the Office Action. Therefore, Applicant respectfully submits that citation of cases and articles

from the 60's and 70's would be improper in this field, as clear improvements in nuclear physics have occurred since that time. Thus, while respectfully submitting that the Office Action has provided no support for its position that "one of ordinary skill in the art would double the operability of the invention", and thus questioning the propriety of the assertion, in an effort to facilitate prosecution, Applicant has submitted herewith two articles and three abstracts showing a more recent view of the field. Therefore, Applicant respectfully submits that the rejection has been overcome, and respectfully requests withdrawal of the rejection.

Conclusion

Based on the remarks above, it is believed that the present application is in complete condition for allowance and favorable action, therefore, is respectfully requested. The Examiner is invited and encouraged to telephone the undersigned, however, should any issues remain after consideration of this Response.

Please charge any additional fees required by this Amendment to Deposit Account No. 04-1403. Respectfully submitted,

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Date

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IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1-31. (Cancelled)

32. (Currently Amended) An exothermic transmutation method for at least partially deactivating radioactive material, the method comprising the steps of:

arranging a dusty compound comprising at least a transition metal Ni and Fe, Cu, graphite, Cr, or combinations thereof, in a chamber of a reactor outside of a closed container, where the closed container is in the chamber of the reactor;

arranging the radioactive material in said chamber, the radioactive material being and staying encapsulated in said closed container;

providing hydrogen in contact with the dusty compound and with the radioactive material at a pressure higher than the ambient pressure;

generating an electric field in the chamber, the electric field being applied to the dusty compound and the radioactive material;

energizing the dusty compound by heating, then generating a transmutation of said at least one transition metal into another transition metal and proton emission towards the radioactive material, said radioactive material being at least partially deactivated,

removing thermal energy from the reactor; and
wherein the pressure in the chamber during electric field generation is greater than 5×10^5 Pa, the chamber contains at least 99% H₂, the initial temperature is between 80 and 200°C, and the electric field is essentially static and is between 20 and 30000 volts/m.

33. (Previously Presented) The method according to claim 32, wherein the radioactive material is a nuclear waste.

34. (Previously Presented) The method according to claim 32, comprising a step of removing air from the chamber and a step of heating the chamber at an initial temperature.

35. (Previously Presented) The method according to claim 52, wherein the dusty compound comprises Ni and Fe, 50% to 95% Ni and 5% to 50% Fe in weight, Ni atoms being transmuted into Cu.

36. (Withdrawn) The method according to claim 52, wherein the dusty compound comprises 1% to 10% Cu in mass.

37. (Withdrawn) The method according to claim 36, wherein the Cu of the dusty compound has at least 99% of particles of an average size between 10 and 100 μm .

38. (Currently Amended) The method according to claim ~~52~~³⁵, wherein the Ni of the dusty compound has at least 99% of particles of an average size not greater than 10 μm , and the Fe of the dusty compound has at least 99% of particles of an average size not greater than 10 μm .

39. (Withdrawn) The method according to claim 52, wherein the dusty compound comprises 25% to 40% graphite in mass.

40. (Cancelled)

41. (Currently Amended) The method according to claim 32, wherein hydrogen is provided before heating and stays in the chamber during the subsequent steps.

42. (Cancelled)

43. (Withdrawn, Currently Amended) The method according to claim ~~5232~~, wherein the dusty compound comprises Cr, the same dusty compound composition is used for various radioactive materials and the same dusty compound is used for a plurality of radioactive material deactivations.

44. (Cancelled)

45. (Previously Presented) The method according to claim 32, wherein the radioactive material is a powder having at least 99% of particles of an average size not greater than 10 μm .

46. (Previously Presented) The method according to claim 32, wherein the hydrogen is deprived of voluntary addition of deuterium and tritium.

47. (Cancelled)

48. (Currently Amended) The method according to claim 32, wherein the electric field ~~and the ultrasonic waves are~~ is generated after heating the chamber at said initial temperature, heating being maintained during a first part of an electric field ~~and ultrasonic waves~~ generation period, heating being stopped at the end of said first part, removing thermal energy starting after said first part.

49. (Currently Amended) The method according to claim ~~3248~~, wherein ~~on the~~ electric field ~~and ultrasonic waves~~ generation period has duration between 1 and 6 hours.

50. (Withdrawn) An exothermic transmutation method for at least partially deactivating radioactive material, the method comprising the steps of:

arranging a dusty compound comprising at least a transition metal in a chamber of a reactor;

arranging the radioactive material in said chamber, the radioactive material being close to or mixed with the dusty compound;

providing hydrogen in contact with the dusty compound and with the radioactive material at a pressure higher than the ambient pressure;

generating an electric field in the chamber, the electric field being applied to the dusty compound and the radioactive material;

energizing the dusty compound by ultrasonic waves, then generating a transmutation of said at least one transition metal into another transition metal and proton emission towards the radioactive material, said radioactive material being at least partially deactivated,

removing thermal energy from the reactor.

51. (Withdrawn) The method according to claim 50, comprising heating the dusty compound and the radioactive material.

52. (Cancelled)