Excitation functions of neutron-induced reactions of some medical isotopes ^{32}P, ^{55}Fe, ^{74}As, ^{97}Ru, ^{103}Ru and ^{109}Pd

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Outline

- Introduction
- Theoretical models
- Results
- Conclusions
- References

Introduction

- Radioactive isotopes have their own physical and chemical properties, perform important roles in technology and actually existing in the field of research.
- Most common application is the use of radioisotopes in the medicine.
- Depending on the decaying properties, medical radioisotopes are classified as therapeutic and diagnostic radioisotopes.
- Diagnostic radionuclides are mainly used in emission tomography.
- Emission tomography is a type of nuclear medicine procedure that measures metabolic activity of the cells of body tissues.

Introduction

- Generally, Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT) are used.
- $^{32}S(n,p)^{32}P$, $^{56}Fe(n,2n)^{55}Fe$, $^{58}Ni(n,\alpha)^{55}Fe$, $^{74}Se(n,p)^{74}As$, $^{98}Ru(n,2n)^{97}Ru$, $^{102}Ru(n,\gamma)^{103}Ru$, $^{103}Rh(n,p)^{103}Ru$, $^{104}Ru(n,2n)^{103}Ru$, $^{108}Pd(n,\gamma)^{109}Pd$, $^{109}Ag(n,p)^{109}Pd$, $^{110}Pd(n,2n)^{109}Pd$, and $^{112}Cd(n,\alpha)$ ^{109}Pd reactions are used to determine the excitation functions of radionuclides ^{32}P, ^{55}Fe, ^{74}As, ^{97}Ru, ^{103}Ru and ^{109}Pd in the neutron energy range 1-20 MeV.

Theoretical Models

- Model based calculations play a very important role in the development of cross-section data.
- TALYS-1.9 and EMPIRE-3.2 codes are used in the present calculations.
- These are computer code systems for the analysis and prediction of the nuclear reactions.
- EGSM is a default level density model used in the present calculations.
- There are various input parameter libraries, FORTRAN codes, and experimental data library (EXFOR), which are operated through the Graphical User Interface (GUI).

Results

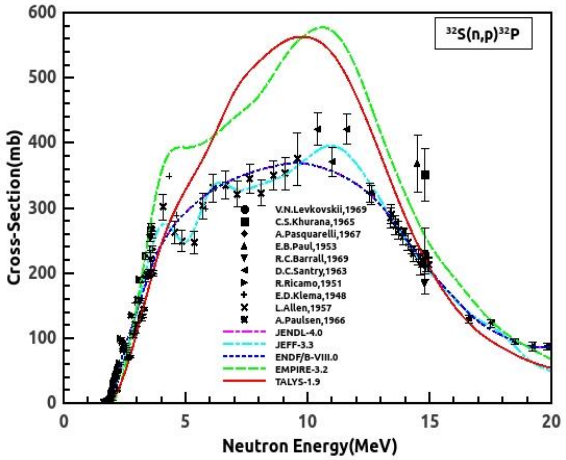


Fig. 1

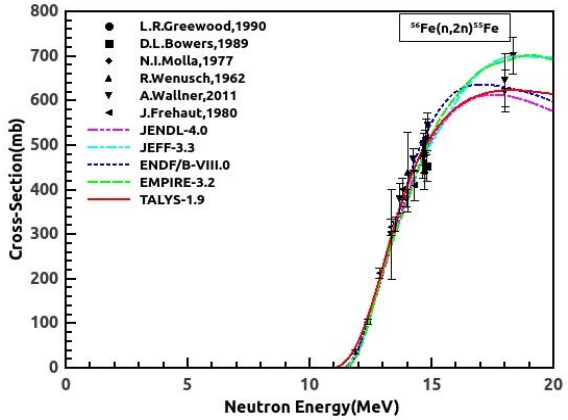


Fig. 2

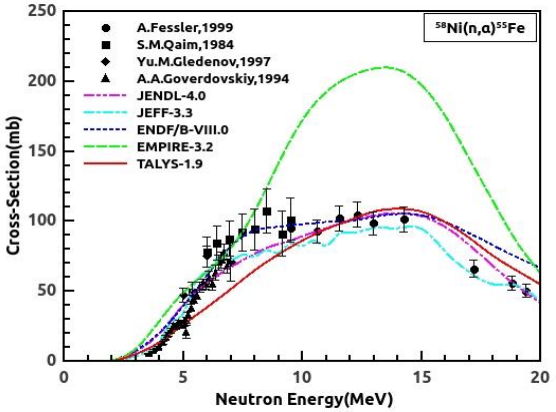


Fig. 3

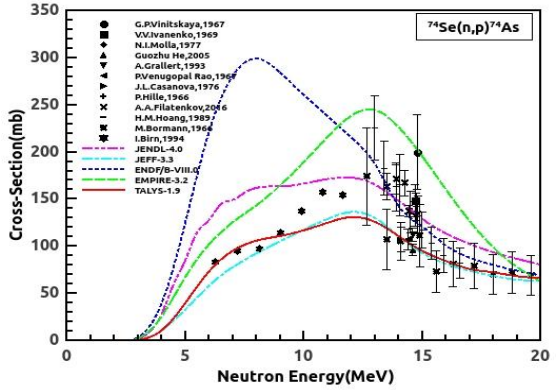
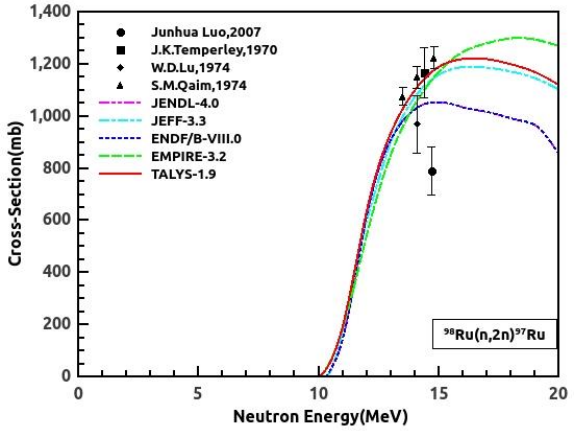


Fig. 4

Results



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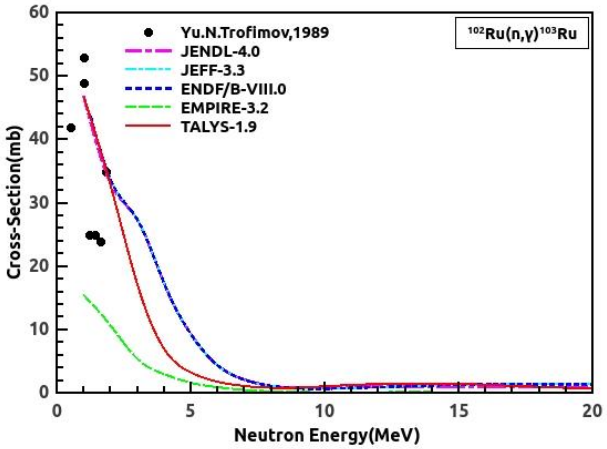

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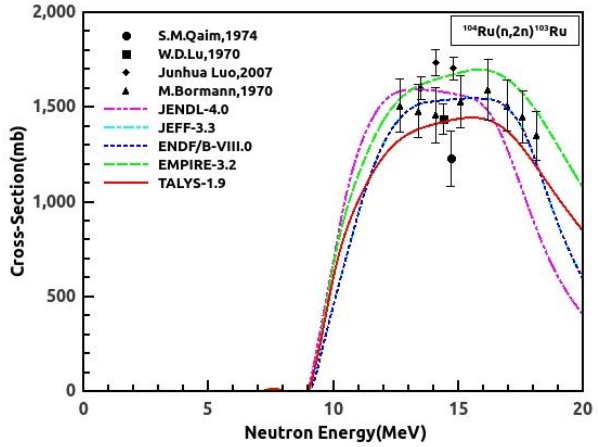

Fig. 7

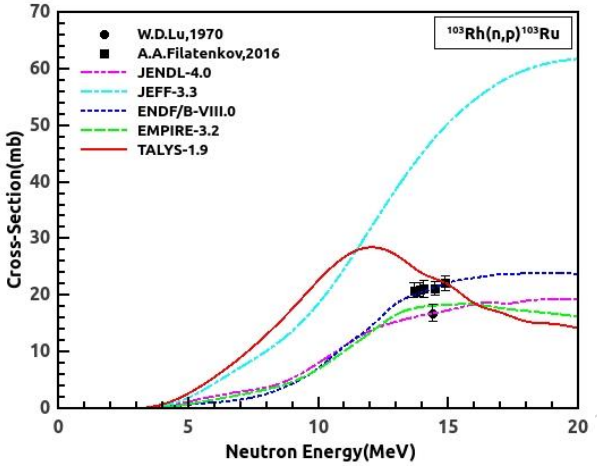

Fig. 8

Results

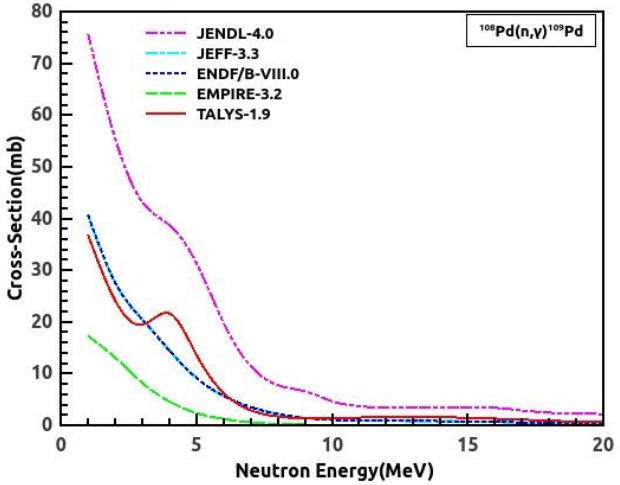

Fig. 9

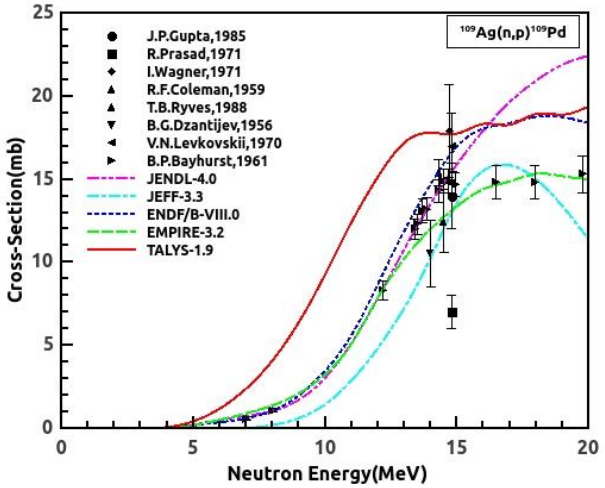

Fig. 10

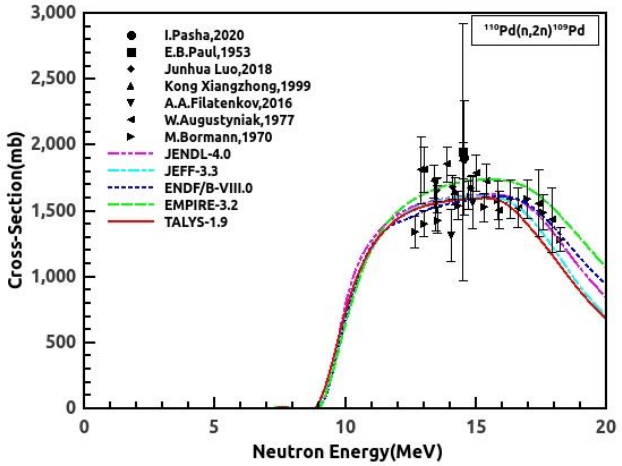

Fig. 11

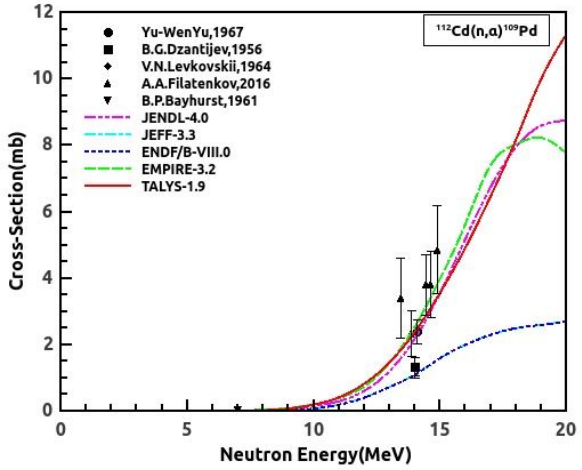

Fig. 12

Conclusions

- In the case of (n,p), (n,2n) and (n,α) reactions, the nuclear reaction cross-sections first increase with the increasing of neutron energy and get the maximum value and then decreases as a function of neutron energy.
- But in case of (n,γ) reactions, the cross-section values are higher at ~ 1 MeV neutron energy due to the contribution of compound nucleus as compared to the pre-equilibrium mechanism and direct reaction.
- The data obtained by using EGSM model of EMPIRE-3.2 code can be used as a reference cross section and it is hoped that they can help in enterprising a well controlled and optimized production of medical radionuclides in the energy range 5-20 MeV.
- The excitation functions of ^{32}P, ^{55}Fe, ^{74}As, ^{97}Ru, ^{103}Ru and ^{109}Pd are medically important and widely used in bone disease treatment, heat source, in biomedical, monoclonal antibodies labelling, imaging, radio labelling and potential radio therapeutic agent.

References

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Thank you