

Evaluations of neutron induced reaction cross sections for $^{35,36,37}\text{Cl}$

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We have performed evaluations of cross sections for neutron induced reactions, (n,tot), (n, γ), (n,p), (n, α), (n,el), (n,2n), etc. on $^{35,36,37}\text{Cl}$ for molten salt reactors, where chloride U, Pu and/or Th are used as nuclear fuel. We have included covariances in our evaluations. Random files for our Total Monte Carlo analyses of integral quantities also will be provided.

Keywords: chlorine, neutron induced reaction, cross section, evaluation, molten salt reactor.

1. Introduction

There is a project on design of molten salt reactors (MSR), where chloride U, Pu and/or Th are used as nuclear fuel. An MSR is a type of nuclear reactor that uses liquid fuel instead of solid fuel rods used in conventional nuclear reactors. Using liquid fuel provides many advantages in safety and simplicity of design. This work aims at evaluations of cross sections for neutron induced reactions on ^{36}Cl as well as the stable isotopes ^{35}Cl and ^{37}Cl for molten salt reactors.

2. Evaluations of neutron induced reaction cross sections for $^{35,36,37}\text{Cl}$

There are two stable isotopes of chlorine: ^{35}Cl (75.76%) and ^{37}Cl (24.24%). However, by neutron capture, ^{36}Cl will be populated and its half life is 30 k years. The produced ^{36}Cl will affect reactor performance and also will be problematic radioactive nuclear waste. Therefore, we have evaluated the cross sections for neutron induced reactions on $^{35,36,37}\text{Cl}$ for molten salt reactors.

There are several nuclear data evaluations on $^{35,36,37}\text{Cl}$ but they do not include covariance data. First, we have surveyed the status of experimental and evaluated nuclear data available for neutron induced reactions, (n,tot), (n, γ), (n,p), (n, α), (n,el), (n,2n), etc. on $^{35,36,37}\text{Cl}$ and have compared the data. And we have performed evaluations of the cross sections for neutron induced reactions on $^{35,36,37}\text{Cl}$ with covariances using the T6 code package including the TALYS [1]. Random files for Total Monte Carlo analyses of integral quantities also will be provided [2].

3. Conclusion

We have performed evaluations of neutron induced reaction cross sections, (n,tot), (n, γ), (n,p), (n, α), (n,el), (n,2n), etc. for $^{35,36,37}\text{Cl}$ with covariances for molten salt reactors. And we have obtained random files for Total Monte Carlo analyses of integral quantities.

References

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