

先进液态成型技术与相场法专栏

专栏导语

液态成型技术作为历史最悠久、应用最广的金属加工核心工艺，贯穿了人类工业文明，是高端装备制造、轻量化材料研发等领域的关键支撑。近年来，随着高端制造业转型升级、新材料迭代及行业对精密、绿色、高效的需求升级，先进液态成型技术正向精密化、轻量化、智能化、绿色化迈进，传统液态成型工艺迎来了革新，先进加压液态成型、半固态成型等新技术涌现，数值模拟手段与相场法的融合，更将工艺从“经验试错”转向“精准设计”，改写了行业研发范式，带来了新的发展机遇与挑战。相场法与工艺优化技术的深度应用可以有效缩短研发周期、降低成本，助力行业实现绿色高效发展。同时，液态成型作为金属加工核心技术，虽面临挑战，但通过技术创新，将在材料、理论、模拟、工艺及设备等方面实现突破。因此，未来需推动先进液态成型技术与相场法深度融合，助力科研成果落地，为高端制造业高质量发展、关键材料国产化提供支撑。

本专栏聚焦领域前沿，汇集了新材料、先进成型技术与智能设计、数值模拟、相场法的融合成果。具体地，本专栏主要聚焦镁基复合材料半固态制备技术研究，结合铝合金、镁合金加压液态成型与高性能材料相场法设计与工艺优化，解决了成分优化和成型缺陷，提升了力学性能；针对高强钛合金开展热处理调控组织性能研究，调控成型场量并依托相场法揭示相变规律，攻克了成型难题，同时探究了热处理对耐磨钢性能的影响；围绕形状记忆合金马氏体相变特性，精细化设计了成型工艺，借助相场法集成方法把控相变与晶粒取向，拓宽了应用场景。这些研究内容覆盖工艺优化、机理探究及相场法应用，展现了理论与实践的最新成果。

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客座编辑简介

赵宇宏，中北大学教授，博士生导师，国际教育学院(国际交流合作部、港澳台事务办公室)院长(部长、主任)，北京科技大学/辽宁材料实验室兼职教授。国家万人领军、全国优秀教师、国家百千万人才、科技部中青年科技创新领军人才。教育部共建铝镁材料研发应用协同创新中心主任，新材料智能铸造先进成型山西省重点实验室主任。中国材料研究学会凝固科学与技术分会常务理事、山西省金属学会副理事长、山西省铸造学会副理事长、*Adv. Compos. Hybrid. Mater.* 副主编、*npj Comput. Mater.* 编委，《金属学报(英文版)》编委、《特种铸造及有色合金》青年副主任编委等。主要研究方向为凝固时效相变多尺度数智化研究



和先进材料及其液态成型。致力于相场理论建模、材料设计制备和工艺优化,应用于凝固/时效组织调控、高性能材料设计、过程宏微观数智化。在 *Sci. Adv.*、*Prog. Mater. Sci.*、*npj Comput. Mater.*、*Acta Mater.*、*Int. J. Plasticity* 等期刊发表论文 300 余篇, H 指数 54。授权国内外专利 80 余项, 获省部级及行业科技奖励一等奖 7 项。

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