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# RAFT POLYMERIZATION TECHNOLOGY

A PROCESS FOR MAKING **BETTER** POLYMERS

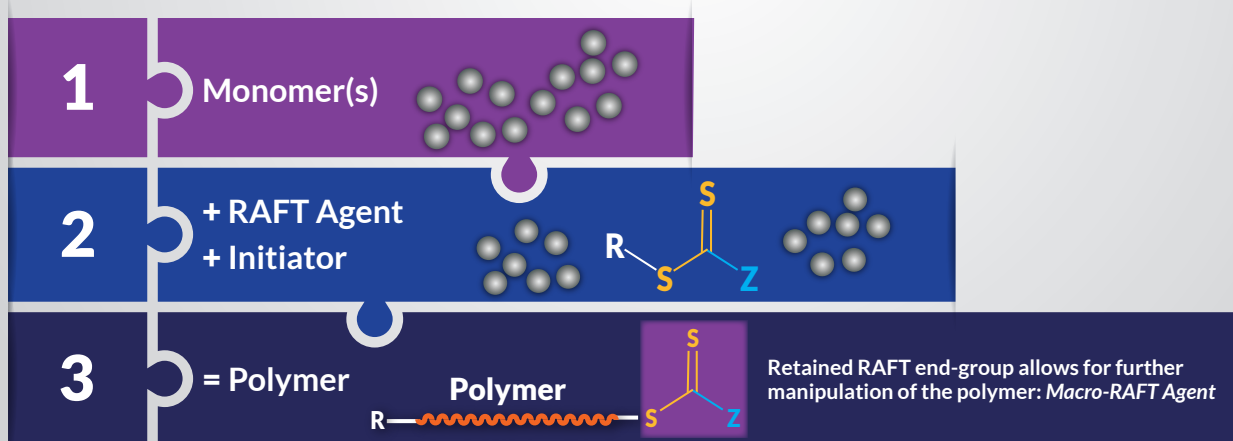
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# ABOUT RAFT

RAFT (Reversible Addition Fragmentation chain Transfer) polymerization technology represents a versatile technique for making polymers.

This technology has revolutionized polymer synthesis and spawned a new generation of polymeric materials, with many new applications in a wide range of fields including engineering materials, electronics, healthcare and biotechnology expected.

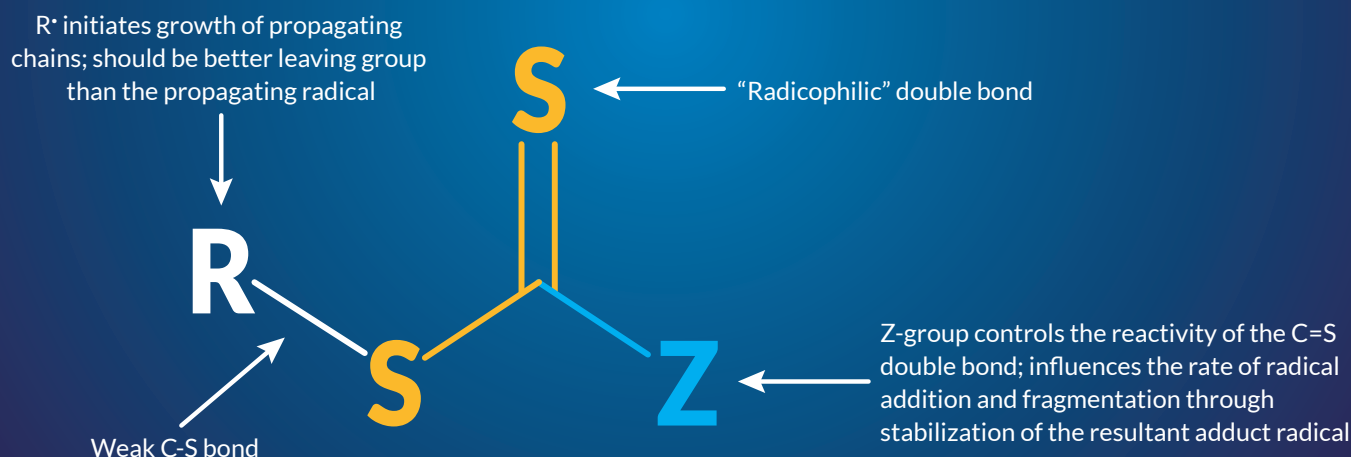
Using RAFT polymerization technology (RAFT) the production of well-defined, end-functionalized polymers, with precisely controlled structure, molecular weight, polydispersity, and with varied functionality can be easily achieved. RAFT is tolerant to a wide variety of reaction conditions and functionalities, and can be performed on existing conventional free-radical polymerization equipment.



## RAFT AGENTS

At the heart of the RAFT process is the RAFT Agent; a small molecule that is responsible for controlling the polymerization process. The RAFT Agent exerts its influence through controlling the steady-state concentration of the propagating polymer chain radicals, and this function is profoundly influenced by the nature of the monomer(s) being polymerized.

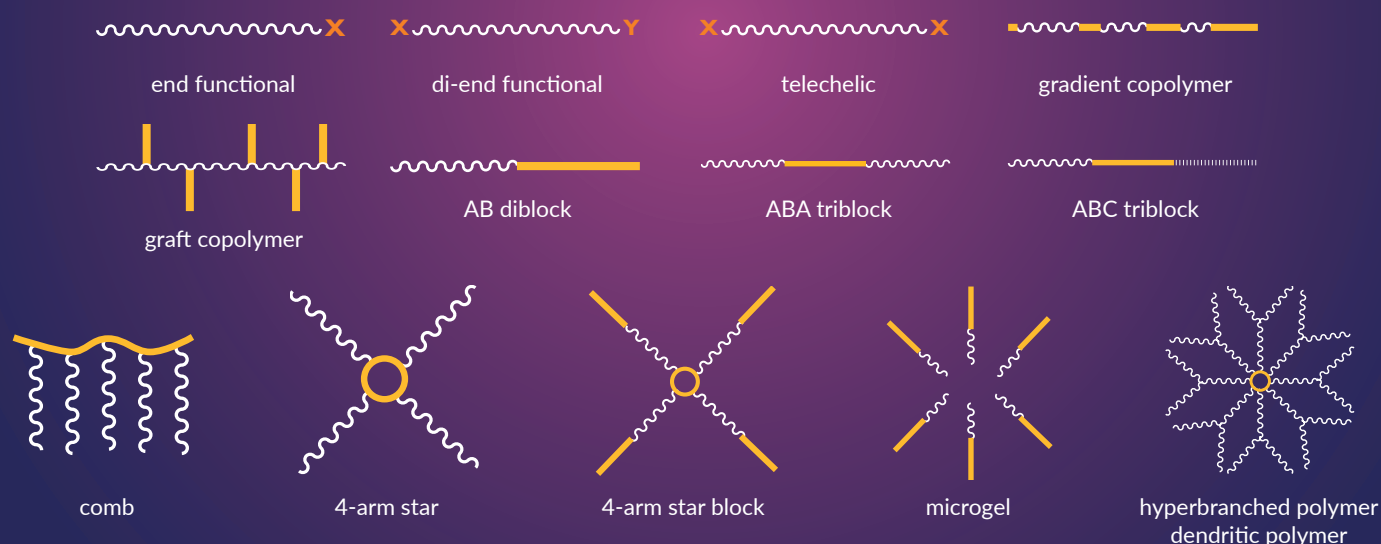
The general structure and key features of a RAFT Agent is shown here. A RAFT Agent typically has a radicophilic thiocarbonylthio group (S=C-S) with substituents R and Z that impact the polymerization reaction kinetics and, importantly, the degree of control. Because of this complex interplay it is not possible for a single RAFT Agent to effectively polymerize all monomer classes.



# RAFT POLYMERIZATION

RAFT gives access to polymers of predetermined molecular size with very narrow molecular size distribution. It also allows the controlled synthesis of complex structures such as diblock, multiblock, hyperbranched and star shaped polymers, polymeric microgels and nanospheres.

Controlled size and narrow size distribution are important because they desirably impact many properties, such as viscosity and processability, while structures such as multiblock and star shaped polymers have unique properties that are sought after for many applications.




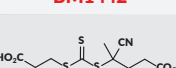
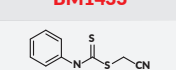
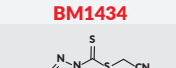
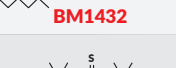
# RAFT AGENT MONOMER SELECTION GUIDE

<p><b>STYRENES</b>    <b>ACRYLATES</b>    <b>ACRYLAMIDES</b></p> <p>2° more activated monomers (2° MAMs)</p>	<p><b>METHACRYLATES</b>    <b>METHACRYLAMIDES</b></p> <p>3° more activated monomers (3° MAMs)</p>	<p><b>VINYL ESTERS</b>    <b>VINYLAMIDES</b></p> <p>2° less activated monomers (2° LAMs)</p>
<p><b>BM1044</b>    <b>BM1433</b></p>	<p><b>BM1433</b>    <b>BM1432</b></p>	<p><b>BM1434</b>    <b>BM1481</b></p>
<p><b>BM1429</b>    <b>BM1640</b></p>	<p><b>BM1432</b>    <b>BM1829</b></p>	<p><b>BM1812</b>    <b>BM1481</b></p>
<p><b>BM1430</b>    <b>BM1829</b></p>	<p><b>BM1829</b>    <b>BM1432</b></p>	<p><b>BM1481</b>    <b>BM1481</b></p>
<p><b>BM1481</b>    <b>BM1812</b></p>	<p><b>BM1432</b>    <b>BM1442</b></p>	<p><b>BM1481</b>    <b>BM1481</b></p>

# RAFT AGENTS AT COMMERCIAL SCALE

Boron Molecular has developed a set of RAFT Agents for both commercial and R&D applications. These versatile, low to no-odour, low cost RAFT Agents are now available in gram to metric tonne quantities. The RAFT Agents – Selection Table is designed to assist the RAFT Technology user to choose the right RAFT Agent to ensure the best polymerization outcome.

## RAFT AGENTS – SELECTION TABLE

	Log P*	 Ph STYRENES	 OR ACRYLATES	 NR <sub>2</sub> ACRYLAMIDES	 OR METHACRYLATES	 NR <sub>2</sub> METHACRYLAMIDES	 OR VINYL ESTERS	 NR <sub>2</sub> VINYLAMIDES
 <b>BM1430</b>	6.56	●	●	●	●	●	●	●
 <b>BM1429</b>	1.54	●	●	●	●	●	●	●
 <b>BM1640</b>	3.22	●	●	●	●	●	●	●
 <b>BM1044</b> (purity ≥ 99%)	5.68	●	●	●	●	●	●	●
 <b>BM1812</b>	15.0	●	●	●	●	●	●	●
 <b>BM1442</b>	7.91	●	●	●	●	●	●	●
 <b>BM1433</b>	1.90	●	●	●	●	●	●	●
 <b>BM1434</b>	3.47	●	●	●	●	●	●	●
 <b>BM1481</b>	2.56	●	●	●	●	●	●	●
 <b>BM1432</b>	6.93	●	●	●	●	●	●	●
 <b>BM1829</b>	2.52	●	●	●	●	●	●	●

● solvent soluble      \*Log P estimated from ChemDraw

● water and solvent soluble (amphiphilic)

● Excellent control of MW; narrow PDI (< 1.1)

● Good control of MW; broad PDI (>1.3)

● Excellent control of MW; moderate PDI (1.1–1.3)

● Not suitable

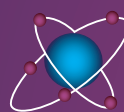
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*In collaboration with:*

