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Materials Processing with FEL Radiation- An Overview¹

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A unique feature of FEL's is their enormously wide range of output parameters, enabling "processing by design". The FEL's energy delivery can be matched to materials properties, accomplishing the intended transformation. The immediate beneficiary is materials R&D, where systematic experimental investigations can now truly dance with computational modeling to make unique materials. For example, depositing energy into specific organic molecular bonds in a time frame too brief for escape into the rest of the molecule, results in selective bond scission. Collecting the ablated fragments on a substrate affords a molecularly faithful coating. Solvent-related complications of conventional coating are avoided, a greater advantage the wider the range of organics to be explored. Sharply adapting the FEL's design to a specific parameter set and taking advantage of the fall of unit cost with increasing power holds promise for applications in manufacturing. Several potential applications in ablative materials synthesis, rapid thermal processing and surface photochemistry will be briefly discussed.

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