Cu-Catalyzed Cross-Coupling Reaction of Grignard Reagents with *primary*-Alkyl Chlorides: Remarkable Effect of 1-Phenylpropyne

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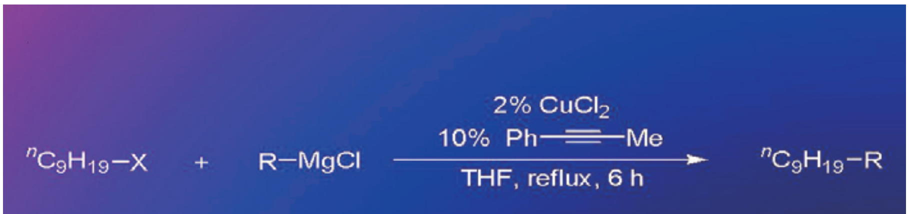
The copper-catalyzed cross-coupling of alkyl halides or sulfonates with Grignard reagents has become one of the most straightforward methods for constructing methylene chains. A serious drawback of this reaction is its non-applicability toward alkyl chlorides, which are promising alkylating reagents because of their wide availability and low cost relative to their iodo and bromo analogues. This lack of reactivity is probably due to the strong C-Cl bond relative to the C-I and C-Br bonds. We have recently reported that Cu catalyzes the cross-coupling reaction of non-activated alkyl fluorides with Grignard reagents in the presence of 1,3-butadiene additives under mild conditions; however, the corresponding alkyl chlorides gave only poor yields of the cross-coupling products. During the cource of this study, we have developed that the Cu-catalyzed alkyl-alkyl cross-coupling reaction between alkyl chlorides and Grignard reagents proceeds efficiently in the presence of 1-phenylpropyne as an additive, and is applicable to alkyl fluorides, mesylates, and tosylates. For example, *n*-nonyl chloride reacted with *n*BuMgCl in the presence of catalytic amounts of $CuCl_2$ (2 mol %) and 1-phenylpropyne (10 mol %) in THF under reflux for 6 h to give tridecane in greater than 98 % yield along with a trace amount of a reduction product, nonane (<1 %). The present Cu-catalyzed cross-coupling reaction proceeds efficiently with *sec*-butyl, *tert*-butyl, and phenyl Grignard reagents. It should be noted that alkyl fluorides and mesylates can also undergo the present cross-coupling reaction to give rise to the corresponding products in almost quantitative yields.



X	R = ^{n}Bu	^{s}Bu	^{t}Bu	Ph
F	>98%	>98%	>98%	>98%
Cl	>98%	95%	>98%	82%
Br	>98%	>98%	>98%	>98%
OMs	>98%	96%	>98%	>98%
OTs	>98%	>98%	>98%	>98%

Texturization of Multicrystalline Silicon Wafers for Solar Cells by Chemical Treatment Using Metallic Catalyst

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In order to increase the efficiency of silicon solar cells, the surface reflectivity must be lowered so that incident photons are absorbed as many as possible. In the case of single crystalline solar cells, the ideally textured surface is produced by utilizing the anisotropic etching in alkaline solution. However, this method cannot be applied to multicrystalline silicon wafers, which are now used most commonly in practical solar cells due to their low production cost. This is because different crystalline faces are exposed to the surface.

In order to lower the surface reflectivity of multicrystalline silicon wafers, we have developed a new method for texturizing their surface using a chemical reaction catalyzed by nano-sized metal particles, such as silver particles. The multicrystalline silicon solar cells made of the wafers textured by this method showed lowered reflectivity and increased photocurrent density. As a result, the efficiency of the solar cell reached 16.7 %, which was about 1%(absolute) higher than the efficiency of the cell with a surface treated by the conventional method.