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AY 2019-2020 Progress Report

Background & Significance

Provide an introduction that provides background context and NASA significance for the study. 150 words maximum.

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Phosphorus-based small molecules and materials have promising properties for the aerospace industry including energy storage via hydrogen fuel cells, 3D printing materials, novel electronic properties, molecular wires, CO_2 activation and storage, low temperature elasticity, and lightweight heat resistant materials. Additionally, these molecules are integral molecules in organic synthesis, catalysis, materials science and biologically active molecules.

Despite ,ica2 (SA) 0.242 (a) 0.2 (a) 0.2 (ET 0.2 (e) 0. 9.7 -0.2 (A) 0.242-.2 (c) 0.2r (l) 0 0.2 (c) 0.2 (ul) 0.

E #$2,)0&3#.#2$+"'+$0&<<#.0,'((4$'3',('6(#$F,);'0#+4('0#+&8'+&=0&--#.;@@=$;G7;'0'0=!"#"=5$ '$.#'%#8+$*&782$,8$<&)+$('6&.'+&.,#)5$,)$'$",%"(4$'0+,3#$"42.&-"&)-",8'+,&8$0'+'(4)+9$"$,)$)7-#.,&.$,8$+#.<)$&*$'0+,3,+4$1"#8$0&<-'.#2$+&$6&+"$&7.$,8,+,'((4$-.&-&)#2$,.&8$>?@$0&<-(#B#)$&.$ (,+#.'+7.#$0'+'(4)+)9$$H82#.$+"#.<'($0&82,+,&8)5$+"#$'0+,3,+4$&*!"$,)$0&<-'.'6(#$+&$)&<#$&*$+"#$6#)+$ -.#3,&7)(4$.#-&.+#2$0'+'(4)+)9$I&1#3#.5$782#.$'<6,#8+$+#<-#.'+7.#$,..'2,'+,&8$0#8+#.#2$'+$JKL$ 8<5$+"#$0&83#.),&8)$'.#$.#<'.M'6(#9$$N'84$.#'0+,&8)$1,+"$"$'.#$0&<-(#+#$,8$<,87+#)5$.'.#(4$.#-&.+#2$78'0+,3'+#2$)76)+.'+#)$'0",#3#$",%"$0&83#.),&8)$1,+",8$"&7.)$'82$)#3#.'($8#1$)76)+.'+#)$ '.#$'00#)),6(#9$$

This discovery represents a potential change in the way hydrophosphination will be approached in the future. **1** ,)$78,07#$'<&8%$'0+,3#$"42.&-"&)-",8'+,&8$0'+'(4)+)$6#0'7)#$,+$0'8$ 6#$"'82(#2$*.&<$'$6#80"+&-$1,+"&7+$)-#0,'($0&82,+,&8)5$,+$,)$',.A$'82$1'+#.A)+'6(#5$,)$#')4$+&$ "'82(#5$'82$#B",6,+)$(&1A+&B,0,+4$9!"#)#$-.&-#.+,#)5$,8$0&8/780+,&8$1,+"$+"#$",%"$'0+,3,+4$&*$"5$ '((&1$*&.$'84$)48+"#+,0$0"#<,)+$&.$<'+#.,'()$)0,#8+,)+$+&$7)#$"42.&-"&)-",8'+,&8$*&.$#B-(&,+'+,&8$,8$('+#$)+'%#$2,3#.),*,0'+,&8$&*$&.%'8,0$<&(#07(#)$&.$<&2,*,0'+,&8$&*$<'+#.,'()9

The -"&+&0'+'(4+,0$0&82,+,&8)$'.#$0.,+,0'($,8$+",)$.#'0+,&8$P7.+"#.<&.#5$(,%"+$'--#'.)$+&$6#$ ' general strategy for enhanced hydrophosphination reactivity as several copper compounds exhibited improved reactivity under irradiation9$$

$$ N#0"'8,)+,0$1&.M$)7%%#)+)$2,3#.%,8%$-'+"1'4)$2#-#82,8%$&8$+"#$)76)+.'+#5$$.#2&B$'0+,3'+,&8$&*$0&--#.5$'82$*&.<'+,&8$&*$'0&--#.A-"&)-",2&$,8+#.<#2,'+#5$'(($&*$1",0"$,8*&.<$*7.+"#.$0'+'(4)+$2#3#(&-<#8+9$$!"#$8#B+$)+#-$,8$+",)$-.&/#0+$,)$+&$*7.+"#.$#B-(&.#$+"#$.#'0+,3,+4$&*$"$,8$'22,+,&8'($6&82$*&.<,8%$.#'0+,&8)5$'82$+&$)48+"#),Q#$8#1$'0+,3#$ #8'8+,&)#(#0+,3#$0'+'(4)+)$7),8%$1"'+$1#$"'3#$(#'.8#29$$

@8$0&80(7),&85$+",)$),<-(#5$6#80"A)+'6(#5$,8#B-#8),3#$0'+'(4)+$,)$",%"(4$#**#0+,3#$'82$ -('0#)$"42.&-"&)-",8'+,&8$,8$+"#$"'82)$&*$<'84$<&.#$)48+"#+,0$0"#<,)+)9$$!",)$1&.M$"')$6##8$)76<,++#2$+&$+"#$R&7.8'($&*$+"#$S<#.,0'8$G"#<,0'($T&0,#+4$*&.$-76(,0'+,&8$9$$

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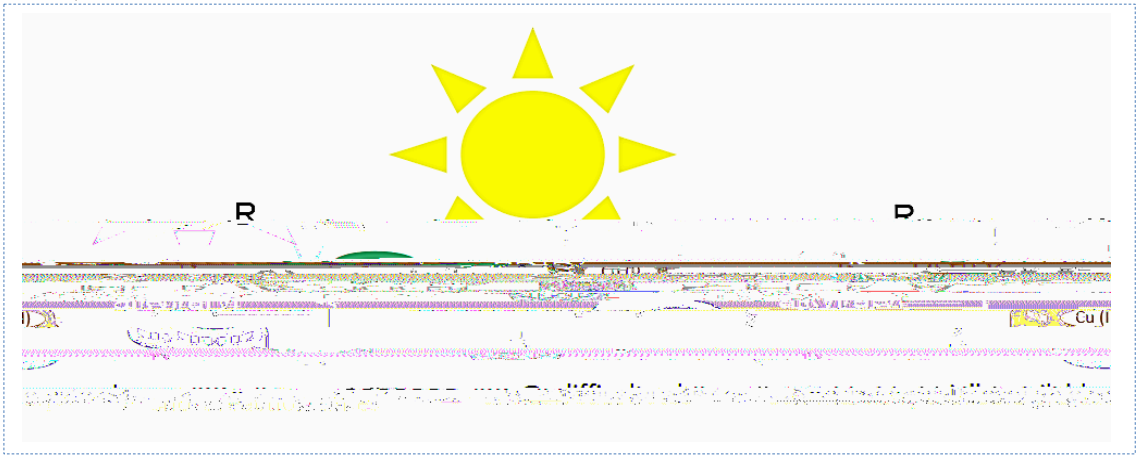

Photocatalytic Hydrophosphination with Air-Stable and Commercially Available Bis(acetylacetonato)copper(II) ($Cu(acac)_2$, **1**)