2022 Spring Technical Meeting of the Central States Section of The Combustion Institute
Wayne State University, Detroit, MI
15 – 17 May 2022

Sunday, 15 May 2022

4:00 – 6:30 Registration: Second Floor of Student Center
6:00 – 8:00 Welcome Reception: Ballroom, Second Floor of Student Center

Monday, 16 May 2022

7:00 - 4:00 Registration: Second Floor of Student Center
7:00 - 8:00 Continental Breakfast: University Towers Cafe
8:00 – 8:15 Opening Remarks and Announcements in Ballroom, Second Floor of Student Center:
Waruna Kulatilaka, Chair-Elect, CSSCI and **Omid Samimi-Abianeh**, Local Host

8:15 - 9:15 Plenary Lecture in Ballroom, Second Floor of Student Center**: Dr. Kuo-Cheng (Steven) Lin,** Air Force Research Laboratory (AFRL)
Title: *Exploration of Liquid Sprays Relevant to High-Speed Air-Breathing Propulsion Systems Using X-Ray Diagnostics*
Session Chair: S.F. Son

9:15 - 9:25	**Transition to Morning Sessions**			
	Detonations I **Hilberry A** **Session Chair: A.K. Agrawal**	**Laminar Flames I** **Hilberry B** **Session Chair: C. Mulvihill**	**Alternate Fuels & Emissions I** **Hilberry C** **Session Chair: M. Tomar**	**Fire/Industrial** **Hilberry EF** **Session Chair: D. Witkowski**
09:25 - 9:45	**1A01: Influence of liquid phase evaporation on one-dimensional detonation propagation for cryogenic hydrogen/oxygen mixtures** *J.G. Smith, B. McN Maxwell* *Case Western Reserve University*	**1B01: Experimental measurement of the rapid mixing of fuel and air in a multi-element diffusion (Hencken) burner** *Q. Meng[1], C. Banyon[2], A.L. Kastengren[2], M.S. Wooldridge[1], R.S. Tranter[2]* *[1]University of Michigan* *[2]Argonne National Laboratory*	**1C01: Comparison of lean blowout achieved by increasing the airflow for four national jet fuel combustion program fuels** *K.M. Tacina, Y.R. Hicks, T.G. Capil* *NASA Glenn Research Center*	**1D01: Effects of confinement on opposed-flow flame spread over thin solids in microgravity** *A. Sharma[1], Y. Li[1], Y.-T. T. Liao[1], P.V. Ferkul[2], M.C. Johnston[3], C. Bunnell[4]* *[1]Case Western Reserve University* *[2]USRA, NASA Glenn Research Center* *[3]National Aeronautics and Space Administration* *[4]ZIN Technologies*
9:45 - 10:05	**1A02: Detonation re-initiation behind an obstacle using a global 4-step combustion model** *G. Floring, M. Peswani,* *B. McN. Maxwell* *Case Western Reserve University*	**1B02: Methane laminar flame speed measurement at high gas temperatures using RCM-flame** *T. Goyal, O. Samimi-Abianeh* *Wayne State University*	**1C02: CO_2 recycling using catalytic corn stover gasification** *R. Roncancio[1], A. Bora[1,2], J.P. Gore[1]* *[1]Purdue University* *[2]Tezpur University*	**1D02: Material degradation during combustion and flame spread** *I.S. Wichman[1], S. Hossain[1,2]* *[1]Michigan State University* *[2]E&PS Core R&D, Dow Chemical*

	Detonations I Hilberry A Session Chair: A.K. Agrawal	Laminar Flames I Hilberry B Session Chair: C. Mulvihill	Alternate Fuels & Emissions I Hilberry C Session Chair: M. Tomar	Fire/Industrial Hilberry EF Session Chair: D. Witkowski
10:05 - 10:25	**1A03: Simulating the critical regime following detonation diffraction in a weakly unstable mixture** *M. Peswani, G. Floring, B. McN. Maxwell* *Case Western Reserve University*	**1B03: Investigation on the effect of adsorption tendency of ammonia in a spherically propagating flame apparatus and its impact on laminar flame speed** *Y.M. Almarzooq, S.A. Alturaifi, M.A. Turner, E.L. Petersen* *Texas A&M University*	**1C03: Comparing the effect of reference velocity for flame structure and speciation in Jet fuels A-2 and C-4** *Y.R. Hicks, T.G. Capil, K.M. Tacina* *NASA Glenn Research Center*	**1D03: Ignition propensity of structural materials exposed to multiple firebrands in Wildland-Urban Interface (WUI) fires: Effects of firebrand distribution and ambient wind** *B. Kwon, Y.-T. T. Liao* *Case Western Reserve University*
10:25 - 10:45	**1A04: Wave mode characteristics of a radial rotating detonation engine** *D.G. Langner, A. Gupta, D.A. McClinton, A.K. Agrawal* *The University of Alabama*	**1B04: Experimental and computational structural evaluation of ammonia-hydrogen and air non-premixed counterflow diffusion flame** *C.F. Goertemiller, D.E. Thomas, W.F. Northrop* *University of Minnesota*	**1C04: Estimation of UNIFAC group composition of fuels using hydrocarbon group type analysis** *J.M. Mehta, P.T. Lynch, K. Brezinsky* *University of Illinois at Chicago*	**1D04: Ammonia for industrial combustion** *S. Londerville[1], M. Whelan[1], C. Baukal[2], A. Gueniche[3], P. Newman4* *[1]John Zink Hamworthy Combustion, Sacramento, CA* *[2]John Zink Hamworthy Combustion, Tulsa, OK* *[3]John Zink International Luxembourg, Dudelange, Luxembourg* *[4]Hamworthy Combustion Engineering*
10:45 - 11:05	**BREAK**			
	Diagnostics I Hilberry A Session Chair: O. Samimi-Abianeh	**Laminar Flames II Hilberry B Session Chair: M.W. Renfro**	**Reaction Kinetics I Hilberry C Session Chair: S. Elliott**	**Indust. & Applied Hilberry EF Session Chair: C.E. Baukal**
11:05 - 11:25	**1A05: Simultaneous Kr thermometry and H atom measurements in flames using a single, broadband femtosecond laser** *P. Parajuli, M. Hay, W.D. Kulatilaka* *Texas A&M University*	**1B05: Laminar non-premixed flames of gaseous fuel aboard the International Space Station** *D.P. Stocker* *NASA Glenn Research Center*	**1C05: N_2O decomposition: New perspectives on a historically challenging system** *C.R. Mulvihill, K.B. Moore III, A.W. Jasper, S.J. Klippenstein* *Argonne National Laboratory*	**1D05: Computational fluid dynamics modeling of lean blowout dependence on operating conditions in the ARC-M1 gas turbine combustor** *D. Dasgupta[1], S. Som[1], E. Wood[2], T. Lee[2], E. Mayhew[3], J. Temme[3], C.-B. Kweon[3]* *[1]Argonne National Laboratory* *[2]University of Illinois at Urbana-Champaign* *[3]Vehicle Technology Directorate, Combat Capabilities Development Command Army Research Laboratory, Aberdeen Proving Ground*

	Diagnostics I Hilberry A Session Chair: O. Samimi-Abianeh	Laminar Flames II Hilberry B Session Chair: M.W. Renfro	Reaction Kinetics I Hilberry C Session Chair: S. Elliott	Indust. & Applied Hilberry EF Session Chair: C.E. Baukal
11:25 - 11:45	**1A06: Species quantification during n-heptane autoignition using filtered natural emission of species** *J.A. Piehl, O. Samimi-Abianeh* *Wayne State University*	**1B06: Experimental and predicted onset of cellular instability in spherically expanding flames** *M.A. Turner, E.L. Petersen* *Texas A&M University*	**1C06: Numerical modeling and experimental measurement of n-heptane autoignition at RCM conditions** *T. Goyal, M. Molana, O. Samimi-Abianeh* *Wayne State University*	**1D06: Spark-ignition imaging of niacin and aluminum dust clouds in the MIKE3 minimum ignition energy testing device** *C. Schweizer, C.V. Mashuga,* *W.D. Kulatilaka* *Texas A&M University*
11:45 - 12:05	**1A07: Quantification of three-stage n-pentane autoignition using filtered natural emission of species** *J.A. Piehl, O. Samimi-Abianeh* *Wayne State University*	**1B07: Structure and nitric oxide formation in laminar diffusion flames of ammonia-hydrogen and air** *D.E. Thomas, C. Wadkar,* *C.F. W. Goertemiller, W.F. Northrop* *University of Minnesota*	**1C07: Adiabatic ignition delay measurement in a rapid compression machine** *M. Molana, J.A. Piehl, O. Samimi-Abianeh* *Wayne State University*	**1D07: Experimental investigation of ideal burning conditions for JP-8 in a compact burner** *M.G. Sandberg, O. Mathieu, E.L. Petersen* *Texas A&M University*
12:05 - 12:25	**1A08: A Raman spectroscopy based chemometric approach to predict the derived cetane number of hydrocarbon jet fuels** *D. Ambre, M. Sheyyab, P. Lynch,* *K. Brezinsky* *University of Illinois at Chicago*	**1B08: Flame characterization using combined progress variable and mixture fraction in a laminar premixed jet in vitiated coflow** *M.L. McKinney, G. Marie, M.W. Renfro* *University of Kentucky*	**1C08: Laminar flame speed, ignition delay time, and CO laser absorption measurements of a gasoline-like blend of pentenes** *C.M. Grégoire[1], C.K. Westbrook[2],* *S.P. Cooper[1], M.A. Turner[1], S.A. Alturaifi[1],* *O. Mathieu[1], E.L. Petersen[1]* *[1]Texas A&M University* *[2]Lawrence Livermore National Laboratory*	
12:30 - 1:30	**LUNCH – University Towers Cafe**			
1:30 - 2:30	**Plenary Lecture** in Ballroom, Second Floor of Student Center**: Dr. Peter (Pete) Schihl,** U.S. Army CCDC **Title:** *U.S. Army Ground Vehicle Fuels and Internal Combustion Engines Perspective* **Session Chair:** T. Jacobs			
2:30 – 2:50	**CSSCI Business Meeting in Ballroom, Second Floor of Student Center**			
2:50 – 3:00	**Transition to Afternoon Sessions**			

	Detonations II Hilberry A Session Chair: B. Maxwell	IC Engines I Hilberry B Session Chair: H.D. Sapra	Theory Modeling Hilberry C Session Chair: K. Senecal
3:00 - 3:20	**1A09: Measurements of gas temperature and species concentrations of n-pentane mixture during autoignition** *M. Molana, O. Samimi-Abianeh* *Wayne State University*	**1B09: Investigation of hole-to-hole and shot-to-shot variations of a multi-hole diesel injector under non-evaporating conditions** *A. Loper, E. Bogdanowicz, J. Bittle, A.K. Agrawal* *University of Alabama*	**1C09: Peroxy radical (RO_2) + OH reactions and their relevance in combustion simulations** *J. Cho, C.R. Mulvihill, S.J. Klippenstein, R. Sivaramakrishnan* *Argonne National Laboratory*
3:20 - 3:40	**1A10: Measurements of geometric detonation amplification with C_3H_8, CH_4, and C_2H_4 mixtures using N_2O** *B. Millard, D. Cuppoletti* *University of Cincinnati*	**1B10: Prediction of derived cetane number using only UNIFAC group compositions of hydrocarbon mixtures with machine learning** *M. Sheyyab, J.M. Mehta, P.T. Lynch, K. Brezinsky* *University of Illinois at Chicago*	**1C10: Surrogate fuel chemistry from ReaxFF molecular dynamics** *F.J. Guzman* *NASA Glenn Research Center*
3:40 - 4:00	**1A11: Pulsed microwave energy deposition in a sodium seeded micro-channel detonation** *F. Reinbacher, J. Lynch, S. Subramaniam, T. Sippel, J.B. Michael* *Iowa State University*	**1B11: Compression ignition combustion of a gasoline-diesel blend in a light-duty engine** *T.H. Kroeger, T.J. Jacobs* *Texas A&M University*	**1C11: Enabling high order fluid property models in CFD for supercritical fuel mixing through neural networks and tabulation** *Z. Harris, A. Agrawal, J. Bittle* *The University of Alabama*
4:00 - 4:20	**BREAK**		
	Diagnostics II Hilberry A Session Chair: J. Michael	**Alternate Fuels & Emissions II Hilberry B Session Chair: N. Sophonrat**	**Reaction Kinetics II Hilberry C Session Chair: J. Cho**
4:20 - 4:40	**1A12: Single-laser excitation/detection of NO, O, and O_2 for NO formation studies in flames** *M. Hay, P. Parajuli, W.D. Kulatilaka* *Texas A&M University*	**1B12: Hydrogen blending into a tankless water heater with gas sensors monitoring** *Y. Zhao, P. Glanville, A. Fridlyand, B. Sutherland* *Gas Technology Institute*	**1C12: Pyrolysis rates of bamboo** *A. Bora[1,2], R. Roncancio[1], S. Mahapatra[2], J.P. Gore[1]* *[1]Purdue University* *[2]Tezpur University*

	Diagnostics II Hilberry A Session Chair: J. Michael	Alternate Fuels & Emissions II Hilberry B Session Chair: N. Sophonrat	Reaction Kinetics II Hilberry C Session Chair: J. Cho
4:40 - 5:00	**1A13: Optimal channel selection for derived cetane number prediction in non-dispersive near and short-wave IR sensors** *A. Sutar, A. Dalmiya, M. Sheyyab, W. Wang, K. Brezinsky, P.T. Lynch* *University of Illinois at Chicago*	**1B13: Simple autoignition model for the derived cetane number of oxygenated compounds and fuel blends** *D. Witkowski, M. Groendyk, D.A. Rothamer* *University of Wisconsin Madison*	**1C13: A study of the effects of steam addition on ammonia hydrogen air combustion** *S. Bhaduri, J.P. Gore* *Purdue University*
5:00 - 5:20	**1A14: IR based derived cetane number prediction of jet fuels from samples of neat hydrocarbons and their mixtures** *A. Dalmiya, M. Sheyyab, K. Brezinsky, P.T. Lynch* *University of Illinois at Chicago*	**1B14: Flame speciation and structure of a Jet-A fuel and a synthetic iso-paraffinic kerosene fuel using a single-cup lean direct injector** *T.G. Capil, K.M. Tacina, Y.R. Hicks* *NASA Glenn Research Center*	**1C14: Automated construction of fully representative stereochemical reaction mechanisms** *K.B. Moore III[1], S.N. Elliott[1], A.V. Copan[2], C.R. Mulvihill[1], L.P. Maffei[1], S.J. Klippenstein[1]* *[1]Argonne National Laboratory* *[2]Emmanuel College*
6:30 - 9:00	**Banquet at the Detroit Institute of Arts** 5200 Woodward Ave, Detroit, MI 48202 (walking distance from student center)		

Tuesday, 17 May 2022

7:30 - 12:00 **Registration:** Second Floor of Student Center
7:00 - 8:00 **Continental Breakfast:** University Towers Cafe
8:00 – 8:05 **Announcements** in Ballroom, Second Floor of Student Center
Omid Samimi-Abianeh, Local Host

8:05 - 9:05 **Plenary Lecture** in Ballroom, Second Floor of Student Center**: Dr. Monique McClain,** Purdue University
Title: *Additive Manufacturing of Composite Energetic Materials*
Session Chair: E.L. Petersen

9:05 – 9:25	**UG Research Competition Winners Presentations: Ms. Ashely James (University Alabama) and Mr. Jacob Klein (Wayne State University)**		
9:25 – 9:35	**Transition to Morning Sessions**		
	Energetic Materials I **Hilberry A** **Session Chair: M.S. McClain**	**Novel Combustion** **Hilberry B** **Session Chair: A. Ratner**	**Reaction Kinetics III** **Hilberry C** **Session Chair: R. Sivaramakrishnan**
9:35 - 9:55	**2A01: Additively manufactured micron and nano Al/PVDF ignition sensitivity and burning characterization** *K. E. Uhlenhake, A.C.C. Hoganson, D.N. Collard, A.D. Brown, J.F. Rhoads, S.F. Son* *Purdue University*	**2B01: Plasma coupled flow reactor studies of non-equilibrium plasma-assisted kinetics of iso-octane and n-heptane blended with ethanol** *K. Bopaiah, N. Tsolas* *Auburn University*	**2C01: A study of OH Measurements during auto-ignition of syngas and siloxane mixtures** *J.H. Kim[1], A.B. Mansfield[2], M.A. Burnett[1], M.S. Wooldridge[1]* *[1]University of Michigan* *[2]Eastern Michigan University*
9:55 - 10:15	**2A02: Oxidation and combustion of Stabilized Lithium Metal Powder (SLMP)** *K. Estala-Rodriguez, S. Cordova, E. Shafirovich* *The University of Texas at El Paso*	**2B02: A novel fuel injection method for diesel engines** *E.F. Bogdanowicz, A. Loper, J. Bittle, A.K. Agrawal* *University of Alabama*	**2C02: High-Temperature shock-tube kinetic measurements of H_2-N_2O mixtures at various N_2 dilution levels** *T.M. Atherley, O. Mathieu, E.L. Petersen* *Texas A&M University*
10:15 - 10:35	**2A03: Development of objective go/no-go criteria for determining the electrostatic sensitivity of novel metal additives** *K.N. Naude[1], E.R. Wainwright[2], L. Giri[3], W.D. Kulatilaka[1], J.L. Gottfried[2]* *[1]Texas A&M University* *[2]DEVCOM Army Research Laboratory* *[3]Bennett Aerospace, Inc.*	**2B03: Stable versus unstable premixed methane/air combustion in micro-channels** *A. Kutkut[1], M. Ayoobi[2], V. Akkerman[1], M.E. Baumgardner[3]* *[1]West Virginia University* *[2]Wayne State University* *[3]Gonzaga University*	**2C03: The role of energy transfer and competing reactions in the thermal and prompt dissociations of allylic radicals** *J. Cho, A.W. Jasper, Y. Georgievskii, S.J. Klippenstein, R. Sivaramakrishnan* *Argonne National Laboratory*

	Energetic Materials I Hilberry A Session Chair: M.S. McClain	Novel Combustion Hilberry B Session Chair: A. Ratner	Reaction Kinetics III Hilberry C Session Chair: R. Sivaramakrishnan
10:35 - 10:55	**2A04: Combustion of metal additives in laminate and composite propellants** *F.A. Rodriguez, J.C. Thomas, G.D. Lukasik, W.D. Kulatilaka, E.L. Petersen* *Texas A&M University*	**2B04: Solution combustion synthesis of iron-based alumina nanocomposites for clean production of hydrogen from fossil fuels** *Z. Chanoi, V. Reyes, E. Shafirovich* *The University of Texas at El Paso*	**2C04: Identification and analysis of chemical reaction modes** *D. Akinpelu, I. Schoegl* *Louisiana State University*
10:55 - 11:15	**BREAK**		
	EM2/Diagnostics III Hilberry A Session Chair: E. Shafirovich	**IC Engines II Hilberry B Session Chair: M. Ayoobi**	**Droplets & Sprays Hilberry C Session Chair: P. Lynch**
11:15 - 11:35	**2A05: Automated image processing method for combustion of iron particles in laminate solid propellants at elevated pressure** *G.D. Lukasik, J.C. Thomas, F.A. Rodriguez, E.L. Petersen, W.D. Kulatilaka* *Texas A&M University*	**2B05:Evaluating energy-assisted compression ignition for high-altitude operation using computational fluid dynamics** *H.D. Sapra[1], R.P. Hessel[1], E.R. Amezcua[1], D. Rothamer[1], K. Kim[2], C.M. Kweon[2], S. Kokjohn[1]* *[1]University of Wisconsin-Madison* *[2]U.S. Army DEVCOM Army Research Laboratory*	**2C05: Influence of turbulence on evaporation of fuel droplets** *A. Jain, S.H. Kim* *The Ohio State University*
11:35 - 11:55	**2A06: A quantitative characterization and calibration technique for high-temperature aerosol phosphor thermometry** *C. Worley, D. Witkowski, D. Rothamer* *University of Wisconsin-Madison*	**2B06: DISI engine combustion system calibration and modeling using genetic optimization and machine learning** *V. Chakrapani[1], C. Zhu[1], A. Mansfield[2], M. Wooldridge[1]* *[1]University of Michigan* *[2]Eastern Michigan University*	**2C06: Statistical description of fuel dispersal in a lean direct injection gas turbine flame using diffuse background illumination** *K. Johnson, M. Johnson, A. James, A.K. Agrawal* *University of Alabama*
11:55 - 12:15	**2A07: High-Speed species-specific imaging of inhomogeneous combustion events through a shock-tube endwall** *D.J. Mohr, M. Hay, W.D. Kulatilaka, E.L. Petersen* *Texas A&M University*	**2B07: In-Cylinder imaging of pre-chamber spark plug flame development in a single-cylinder direct-injection spark-ignition engine** *Chenyi Zhu, V. Chakrapani, M. Wooldridge* *University of Michigan*	**2C07: Modeling multicomponent (preferential) vaporization and combustion properties of jet fuel droplets with accuracy, efficiency, and flexibility** *S. Singer* *Marquette University*

	EM2/Diagnostics III Hilberry A Session Chair: E. Shafirovich	IC Engines II Hilberry B Session Chair: M. Ayoobi	Droplets & Sprays Hilberry C Session Chair: P. Lynch
12:15 - 12:35	**2A08: Turbulent flame characteristics of liquid fueled jet flames using C-X band CH-PLIF** *J. Schihl[1], A.W. Skiba[2], C. Carter[2], A. Gandomkar[1], P.M. Allison[1]* *[1]Michigan State University* *[2]Air Force Research Laboratory*	**2B08: Characterizing shot-to-shot variation under reacting diesel-like spray combustion conditions** *A. Parker, A. Agrawal, J. Bittle* *The University of Alabama*	**2C08: Experimental study on the droplet combustion characteristics of different diesel-biodiesel blends derived from waste vegetables oil and animal fat** *A.S.M. Sazzad Parveg, A. Ratner* *The University of Iowa*
12:35	**Box Lunches – Adjourn**		
1:30	**Optional Wayne State Facility Tours**		

2022 CSSCI SPRING TECHNICAL PAPER OVERVIEW AUTHORS