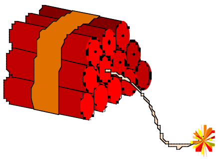

SEKTIONEN FÖR DETONIK OCH FÖRBRÄNNING

www.sdfsweden.se

The Swedish Section for Detonics and Combustion
affiliated with *The Combustion Institute*
(www.combustioninstitute.org)

NEWSLETTER 1/2019

2019-03-21

Fredsteknik/Peace Technology

Editor: Hans Wallin

1. Ny säkerhetsskyddslag/New Swedish Safety Protection Law

Denna lag kommer bl a att påverka Sektionens medlemmar.

Säkerhetsskydd innebär förebyggande åtgärder för att skydda vårt land mot spioneri, sabotage, terrorism och andra samhällsomstörtande brott. Kraven på säkerhetsskyddet har förändrats genom utvecklingen i omvärlden och på informationsteknikområdet, av ökningen av säkerhetskänslig verksamhet bedriven i enskild regi samt av en ökad internationell samverkan.

För att stärka säkerhetsskyddet föreslår regeringen en ny säkerhetsskyddslag. Den nya lagen innehåller krav på åtgärder som syftar till att skydda uppgifter som är av betydelse för Sveriges säkerhet eller som ska skyddas enligt ett internationellt åtagande om säkerhetsskydd. Även skyddet av annan säkerhetskänslig verksamhet, till exempel samhällsviktiga informationssystem, förbättras. Det förtydligas att lagen gäller i både allmän och enskild verksamhet.

Den nya lagen tydliggör skyldigheterna för den som bedriver säkerhetskänslig verksamhet samt vikten av att verksamhetsutövarna genomför säkerhetsskyddsanalyser för sina verksamheter.

Till följd av den nya lagen föreslås även ett antal ändringar i andra lagar. Lagen och följdändringarna i övriga lagar föreslås träda i kraft den 1 april 2019.

Sverige lever idag med ett förhöjt terrorhot. Sprängämnen och tändmedel betraktas som extra stöldbegärliga, vilket medför att tillgreppsskyddet ska motstå tillgreppsförsök med handhållna och elektriska verktyg i minst 80 minuter. (MSBFS2016:3)

Hans Wallin, Cesium AB, Phone +46 (0)72 586 3884

Ed Davidson wrote the statement below

2. DID YOU KNOW?

One de-miner is killed and two injured for every 5000 successfully removed mines.

If de-mining efforts remain about the same as they are now, and no new mines are laid, it will still take 1100 years to get rid of all the world's active land mines.

It is estimated that there are 110 million land mines in the ground right now. An equal amount is in stockpiles waiting to be planted or destroyed. Mines cost between $ 3 and $ 30, but the cost of removing them is $ 300 to $ 1000.

The cost of removing all existing mines would be $50- to $100-billion. According to the '*International Campaign to Ban Landmines network'*, more than 4,200 people, of whom 42 % are children, have been falling victim to landmines and ERWs annually in many of the countries affected by war or in post-conflict situations around the world.

Mine and explosive remnant of war casualties occur in every region of the world, causing an estimated 15,000 – 20,000 injuries each year.

3. En ökad risk för terrordåd i Sverige / An increased risk of terrorist acts in Sweden

Dan Loyd

De kriminella nätverken i Sverige fortsätter som tidigare att bekämpa varandra. Nätverken ägnar sig åt bland annat narkotikahandel Under årets första månader har redan ett antal skjutningar ägt rum och därav flera dödsskjutningar.

Man använder i första hand olika typer av handeldvapen för att bekämpa varandra, men man använder även handgranater och sprängämnen. Tillgången på olagliga handeldvapen är tyvärr fortfarande god i Sverige och det gäller både pistoler och automatvapen. Nätverken verkar också ha god tillgång till handgranater och sprängämnen för framställning av bomber. Orsaken är att det fortfarande är förhållandevis både enkelt och billigt att smuggla in vapen och sprängämnen till Sverige. I huvudsak sker smugglingen från de forna öststaterna.

Än så länge är inte allmänheten det primära målet för de kriminella nätverkens attacker, men några attacker har riktats mot polis och olika myndigheter. Risken finns emellertid alltid att helt oskyldiga personer drabbas när de kriminella nätverken bekämpar varandra och för dem misshagliga personer och myndigheter. Medlemmarna är för det mesta mer skjutglada än skjutskickliga, vilket ökar risken för att allmänheten skall komma till skada.

SÄPO har i sin senaste årsredovisning (mars 2019) konstaterat att hotet mot Sverige har ökat. En av orsakerna är kalifatets sammanbrott, vilket bland annat innebär att vi kan förvänta oss att ett antal ”arbetslösa” IS-krigare har för avsikt att återvända till Sverige. Vid några av de intervjuer som har visats i TV förefaller det som om alla svenska IS-krigare har ägnat sig åt att köra ambulans

As before, criminal networks in Sweden continue to fight each other. The networks deal, i. a., with drug traffic. During the first months of the year, a number of shootings have already taken place and hence several death shootings.

One primarily uses different types of small arms to fight each other, but hand grenades and explosives have also been used. Unfortunately, the availability of illegal small arms is still good in Sweden, and this applies to both guns and automatic weapons. The networks also seem to have good access to hand grenades and explosives for producing bombs. The reason is that smuggling weapons and explosives to Sweden is still relatively simple and cheap. The smuggling mainly takes place from the former eastern states.

So far, the public is not the primary goal of the criminal networks' activities, but some attacks have been directed against police and various authorities. However, there is always the risk that completely innocent people will be affected when the criminal networks fight each other and for those who displease people and authorities. The members are mostly more happy than shooting, which increases the risk of the public getting injured.

In SÄPO's annual report (March 2019), it is stated that the threat to Sweden has increased. One of the reasons is the collapse of the caliphate, which means, among other things, that we can expect a number of "unemployed" IS warriors to return to Sweden. In some of the interviews that have been shown on TV, it seems that all Swedish IS warriors have been involved in ambulance driving or running cafes. Reality is probably completely different. The IS warriors who will return to Sweeller driva kaféer. Verkligheten är förmodligen helt annorlunda. De IS-krigare som kommer att återvända till Sverige på laglig eller olaglig väg har troligen både en omfattande stridserfarenhet och erfarenhet av terrorverksamhet.

De återvändande IS-krigarna är tyvärr inte den enda gruppen som kan tänkas ägna sig åt terrorverksamhet i Sverige. Det finns idag framför allt tre grupperingar som kan utgöra en fara för allmänheten – extrema grupper på högerkanten, autonoma grupper på vänsterkanten och återvändande IS-krigare. Man kan förvänta sig att dessa grupper kommer att både bekämpa varandra och rikta sin terroraktivitet mot olika myndigheter, myndighetspersoner och allmänheten. Man kan också förvänta sig att grupperna kommer att använda sig av handeldvapen, handgranater, sprängämnen och olika typer av bomber.

Vid terrordådet i Nya Zeeland under mars 2019 använde sig gärningsmannen av automatvapen och lyckades döda ett 50-tal helt oskyldiga personer innan han greps. Vid det terrordåd som hände i Nederländerna under mars 2019 använde sig gärningsmannen också av handeldvapen. Om det rör sig om ensamma personer eller om de ingår i någon form av nätverk är för närvarande oklart.

Möjligheten för de kriminella grupperna att på egen hand tillverka bomber är visserligen både komplicerat och riskfyllt, men det är inte omöjligt. Det är inte heller omöjligt för en enskild person att tillverka en bomb. Det finns gott om detaljerade beskrivningar på internet om hur man tillverkar en bomb och de nödvändiga råvarorna kan man anskaffa på olaglig väg.

Man kan också befara att de kriminella grupperna övergår till att använda olika typer av IED – Improvised Explosive Device. En ”traditionell” IED brukar byggas av det som råkar finns till hands såsom artillerigranater, handgranater, stridsvagnsminor, sprängämnen mm plus en lämplig tändanordning. En vanlig användning av en IED är att man placerar den väl dold vid sidan av vägen. När fordon eller grupper av personer passerar utlöser man sprängladdningen och det sker via fjärrutlösning eller via någon form av automatik. En IED kallas ibland för ”vägbomb” eftersom

den on a legal or illegal road are likely to have both extensive experience of war and experience of terrorism.

The returning IS warriors are unfortunately not the only group that can engage in terrorist activities in Sweden. There are today mainly three groups that can pose a danger to the public – extreme groups on the right, autonomous groups on the left, and returning IS warriors. It can be expected that these groups will fight each other and direct their terrorist activity against various authorities, government officials and the public. One can also expect that the groups will use small firearms, hand grenades, explosives and various types of bombs.

At the terrorist attack in New Zealand in March 2019, the perpetrator used the automatic weapon and killed about 50 completely innocent people before he was arrested. At the terrorist act that happened in the Netherlands in March 2019, the perpetrator also used small arms. Whether they are single people or are part of any kind of network is currently unclear.

The possibility for the criminal groups to manufacture bombs on their own is surely both complicated and risky, but it is not impossible. Nor is it impossible for an individual to produce a bomb. There are plenty of detailed descriptions on the internet about how to manufacture a bomb, and the necessary raw materials can be obtained illegally.

One can also fear that the criminal groups are moving to using different types of IED – Improvised Explosive Device. A "traditional" IED is usually built on what happens to be at hand, such as artillery grenades, hand grenades, tank mines, explosives, etc., plus a suitable ignition device. One common use of an IED is to place it well hidden alongside the road. When vehicles or groups of people pass, one triggers the explosive charge from a distance or via some form of automation. An IED is sometimes called "road bomb" because it often is placed next to roads.

Fortunately, the possibility of finding corresponding components for producing a "traditional" IED in Sweden is small. Although the components are available in Sweden, but in guarded military stores. Instead of using den ofta placeras invid vägar.

Möjligheten att i Sverige hitta motsvarande komponenter för att tillverka en ”traditionell” IED är lyckligtvis liten. Komponenterna finns visserligen i Sverige men i bevakade militära förråd. Man skulle istället för artillerigranater, minor och militära sprängämnen kunna använda sig av civila sprängämnen, som man skaffar sig på olaglig väg. De metalldelar som behövs är det inga större problem att skaffa på helt laglig väg. Med hjälp av dessa komponenter är det sedan inga större problem att konstruera en väl fungerande IED.

Idag används stora mängder av civila sprängämnen i Sverige och användningen är spridd över hela landet. Det förbrukas ungefär 100 000 ton om året i Sverige. En viss koncentration av användningen finns i gruvor och större vägprojekt. Det finns därför all anledning att skärpa bevakningen av industrier som tillverkar sprängämnen, civila sprängämnesförråd och inte minst den omfattande transporten av sprängämnen. Vidare måste gränsbevakningen skärpas för att minska tillförseln av olagliga handeldvapen, handgranater och sprängämnen. Straffsatserna i lagstiftningen måste också klart visa på samhällets stora avsky för användning av sådana vapen i civila sammanhang.

Sverige bör utnyttja sitt medlemskap i EU så att man vidtar åtgärder för minska den illegala förekomsten av handeldvapen, handgranater mm inom EU. Vi bör även agera inom två av Förenta nationernas verksamheter – Safer Guard International Ammunition Technical Guide-lines (IATG) och Arms Trade Treaty (ATT) – för att minska tillgången på illegala handgranater globalt.

artillery shells, mines and military explosives, one could use civilian explosives, which can be obtained illegally. The metal parts needed is no major problem, since they can be legally obtained. With the help of these components, it is then no major problem to construct a well-functioning IED.

Today, large amounts of civilian explosives are used in Sweden and their use is spread throughout the country. About 100 000 tons are consumed in Sweden annually. A great deal is used in mines and big road projects. There is therefore every reason to tighten up the monitoring of industries that manufacture explosives, civilian explosives stores and, not least, the extensive transport of explosives. Furthermore, the border guard must be tightened to reduce the supply of illegal small arms, hand grenades and explosives. The penalties in the legislation must also clearly demonstrate society’s great disgust with the use of such weapons in civil contexts.

Sweden should use its membership in the EU so that measures are taken to reduce the illegal presence of small arms, hand grenades, etc. within the EU. We should also act within two of the United Nations operations – Safer Guard International Ammunition Technical Guide-lines (IATG) and Arms Trade Treaty (ATT) – to reduce the availability of illegal hand grenades globally.

Unexpected Fire and Explosion Hazard

In a Swedish newspaper a couple of decennia ago, an accident in connection with deaeration of a hot-water radiator system was reported.

When a woman, holding a lighted cigarette in one hand, bled a radiator, the escaping gas ignited and hurt her. Surprisingly, the "air" turned out to be hydrogen, obviously.

Asked for a reason, Professor Wranglén, Department of Electrochemistry at The Royal Institute of Technology, said that the hydrogen producing reaction "logically" was:

$$3\ Fe + 4\ H_2O \rightarrow 4\ H_2 + Fe_3O_4 \qquad R\ 1$$

For one thing, $Fe(+^{8}/_{3})_3O_4$ cannot be a prime redox product, even if it appears in the final state.

It rather seems to be a question of another reaction formula in need of being sorted out [1], [2].

The purported process in the radiator system is – assuming that low-carbon steel behaves like Fe(s):

$Fe(s), H_2O(l) \rightarrow H_2(g), Fe_3O_4(s)$ P 1

In an established hot-water radiator system, the original dissolved air oxygen has been depleted, therefore no O_2 in the initial state – a process like P 1 takes its time. Thus, water is the oxidiser.

The temperature of the system ought to be about 50 °C. (Being a closed system, it is also characterized by constant pressure – a couple of bar or so, depending on the level of the uppermost radiator.)

Reaction analysis

The redox, or pe diagram [3] for iron is shown in Figure 1. As long as Fe(s) is present, the pe value cannot exceed -7.5 or thereabout (the true value is set by the actual Fe^{2+} concentration).

The diagram tells that Fe(0) is oxidized to Fe^{2+} and Fe^{3+}:

$Fe(0) \rightarrow Fe^{2+} + 2\ e^-$ $-\lg K_r = 15$, $pe^o = -7.5$ R 2

$Fe(0) \rightarrow Fe^{3+} + 3\ e^-$ $-\lg K_r = -2$, $pe^o = -2/3$ R 3

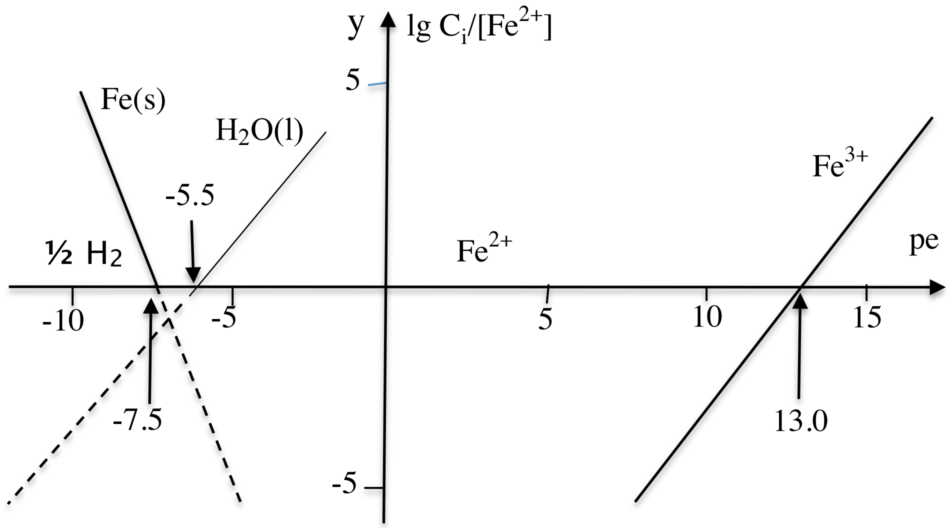

Figure 1. Redox diagram for iron and water at 25 °C and pH = 7.

However, geometry tells that the vertical distance between the horizontal Fe^{2+} line and the Fe^{3+} line is 13 + 7.5 - ⅔ = 20, *i.e.*, $[Fe^{3+}]/[Fe^{2+}] = 10^{-20}$. Thus, Fe^{3+} is out of the picture, and so is the iron product of P 1; this double oxide is formed from the two prime oxides:

$FeO(s) + Fe_2O_3(s) \rightarrow Fe_3O_4(s$ R 4

Remains the electron donor R 2. According to P 1, the acceptor must be water:

$H_2O + 2\ e^- \rightarrow H_2 + O^{2-}$ R 5

The additional exchange species, O^{2-}, indicates that R 1 is not a simple donac reaction [3] – an O^{2-} acceptor must participate. The required half-reaction must be:

$Fe^{2+} + O^{2-} \rightarrow FeO(s)$ R 6

R 2, R 5 and R 6 give:

$$Fe(s) + H_2O \rightarrow FeO(s) + H_2 \qquad \text{R 7}$$

and eventually

$$H_2 \rightarrow H_2(g) \quad \lg (K/b\ M^{-1}) = -3 \qquad \text{R 8}$$

Conclusions and discussion

The process in the actual hydrogen-producing hot-water radiator system is:

$$Fe(s), H_2O \rightarrow FeO(s), H_2(g) \qquad \text{P 2,}$$

not P 1, the chemical reaction being the mono-reaction R 7. But is it a free ($\Delta G < 0$) reaction? The pe diagram for water might give the answer.

With an eye on R 7, an H_2O oxidizer line should be present in the pe diagram. Writing the reaction formula for the proton reaction with water both as a reactant and a product:

$$H_2O(l) + H^+ + e^- \rightarrow \tfrac{1}{2} H_2(g) + H_2O \quad \lg K_r = 0 \text{ (defines the pe scale)} \qquad \text{R 9}$$

and combining it with R 8, we get:

$$H_2O(l) + H^+ + e^- \rightarrow \tfrac{1}{2} H_2 + H_2O \quad \lg K_r = 1.5 \qquad \text{R 10}$$

and the line equation:

$$y \equiv \lg \frac{\{H_2O(l)\}}{\sqrt{[H_2]}} = pe + pH - 1.5 \qquad \text{E 1}$$

Radiator water is neutral, which gives pe(y=0) = -5.5. This line has been superimposed on the iron diagram in Figure 1.

The pe^o intersection points of Fe(s) and H_2O on the Fe^{2+} line are separated by $\Delta pe = 2$, which means that water is – slightly – powerful enough to oxidize iron.

The reduction-constant data used refer to infinite dilution, a condition well fulfilled by radiator water. They are gleaned from Ref. [4] and valid at 25, not 50 °C. Which way experimental temperature data are tending may be concluded from two reduction constants for R 2: $\lg K_r(20\ °C) = -16.06$, $\lg K_r(25\ °C) = -14.89$, *i.e.*, $pe^o = -8.03$ and -7,85, respectively. Thus, for a 5 K temperature decrease, the Fe(s) line moves to the left and Δpe increases by 0.59 units. At a guess, a 25 K temperature increase might turn Δpe zero or negative. For the R 9 $H_2O(l)$ line, $\lg K_r = pe^o = 0$ at all temperatures. Movement of this line depends on R 8, *i.e.*, on the solubility of H_2 only. At 50 °C, $[H_2]$ has decreased by 10 % only [5], and so has Henry's constant. Thus, the line moves to the left diminishing Δpe by 0.1 pe units. At $\Delta pe = 0$, water becomes powerless as to the oxidation of iron.

So, what caused the hydrogen production in the radiator system? R 12 below might – after all – be a comprehensible answer.

Pipe Corrosion

In a fresh radiator system, a more normal reaction partner is present, *viz.*, O_2:

$$O_2 + 4\ e^- \rightarrow 2\ O^{2-} \qquad \text{R 11}$$

which with R 2 and R 5 gives the prime oxygen-depleting – as time goes by – reaction:

$$3\ Fe(s) + O_2 + H_2O \xrightarrow{50\ °C} 3\ FeO(s) + H_2(g) \qquad \text{R 12}$$

Has serendipity – cigarette smoking at the wrong place at the wrong moment – eventually revealed the true nature of radiator "air"?

References

[1] S. R. Johansson. Misconceptions in global reactions and formula writing. Defence Technology **12**:5(2016)419-421.

[2] S. R. Johansson, Elementary Chemical Mathematics. Chemistry in a broader setting. AuthorHouse 2017, Chapter 1, Reaction formula writing.

[3] *Ibid*. Chapter 3, Chemical equilibria.

[4] Stability Constants of Metal Ion Complexes. Special Publication No. 17. The Chemical Society, London 1964.

[5] C. L. Young, Ed., IUPAC Solubility Data Series, Vol. 5/6, Hydrogen and Deuterium, Pergamon Press, Oxford, England, 1979.

Literature

In the Chinese journal *Defence Technology*, January 2019, Baha I. Elzaki & Yue Jun Zhang have published a study titled

Surface Modification of Ammonium Nitrate by Coating with Surfactant Materials to Reduce Hygroscopicity

The abstract runs:

Ammonium nitrate is promising oxidizer in green propellants. In this work, the physical coating method was improved to modify the surface of ammonium nitrate particles with different surfactant materials to reduce hygroscopicity. Cetylalcohol, stearic acid, stearyl alcohol, palmic acid, lauric acid, stearsmide, tetradecylamine, dodecylamine, and tetradecanol were used as coating surfactant agents. The hygroscopicity was tested for ammonium nitrate with and without coating. FTIR and SEM were used to characterize the surface of coated and uncoated ammonium nitrate. The mass ratio of coating layer and decline of absorption rate of ammonium nitrate coated by cetylalcohol were 1.00 %, and 28.40 %, respectively. The results indicate that coating with cetylalcohol surfactant have advantages over the other surfactants in term of low mass ratio of coating layer, and high decline of moisture absorpstion rate. Thus, cetylalcohol would be a promising coating surfactant material for ammonium nitrate. The idea and approach presented in this study have potential to made hydrophobic layer on the surface of particles to reduce hygroscopicity of AN, and also help the researcher to improving anti-hygroscopicity of ammonium salts.

As a possible match industry application example, coating hydroscopic sodium chlorate with stearic acid might perhaps be a substitute for the more expensive non-hygroscopic potassium chlorate. In addition, the stearic acid would be a fuel addition complementing paraffin. Increased match head moisture resistance as a whole might be expected

Conferences
2019

05-06--08 17th International Conference on Numerical Combustion.
German Section of the Combustion Institute, Aachen, Germany.
http://www.nc19.itv.rwth-aachen.de/

05-13--16 11th International Heat Flow Calorimetry Symposium on Energetic Materials,
Fraunhofer ICT, Pfintztal, Germany,
https://www.ict.fraunhofer.de/en/conferences/conferences/hfc-symposium2019.html

06-25--28 50th International Annual Conference of the Fraunhofer ICT, Energetic

Materials – Past, Present and Future.
Karlsruhe, Germany.
https://www.ict.fraunhofer.de/en/conferences/conferences/ann_conf.html

07-07--12 Summer School 2019.
Combustion Institute, Cambridge, England.

07-14--19 The 32nd International Symposium on Shockwaves.
Combustion Institute, University of Singapore, Singapore.

09-11--13 AEM 2019 Advanced Energy Materials.
University of Surrey, Guildford, England.

09-15--18 10th Anniversary EFEE World Conference on Explosives and Blasting.
Scandic Marina Congress Center, Helsinki, Finland, info@efee2019.com

10-13--16 Message from China:

You are cordially invited to participate in the 13th International Autumn Seminar on Propellants, Explosives and Pyrotechnics (13th IASPEP) in Commemoration to the 95th Birthday of Prof. DING Jing (1924–2013) to be held in Beijing, China, October 13–16, 2019.

The seminar accept papers and extended abstracts(1000 words), which must be submitted by website http://www.iaspep.com.cn NO LATER THAN AUGUST 1, 2019. For more details of the seminar, please visit the conference website.

2020

01-26--29 ISEE 46th Annual Conference on Explosives and Blasting Techniques.
Denver, Colorado, USA. mangol@isee.org

06-30--07-2 1st UK International Explosives Conference.
Victory Services Club, Marble Arch, London.

?-?-? Second International Conference on Defence Technology (2nd ICDT).
China somewhere. info@symposiaatshrivenham.com

Education and Training

Sverige

KCEM. För aktuella konferenser och kurser, se www.kcem.se.

FOI. Grundkurs i explosivämneskunskap. http://www.foi.se.

U. K.

University of Leeds. www.leeds.ac.uk.

The Royal Military College of Science. www.rmcs.cranfield.ac.uk.

Imperial College, London
Best practices guidelines for CFD of turbulent combustion.
London, 11th and 12th December 2019.

U. S. A.

Franklin Applied Physics. Visit info@franklinphysics.com.
Courses on Electroexplosive Devices: Functioning, Reliability, and Hazards will be held in Oaks, PA, USA, 22-25 July 2019.

International Society of Explosives Engineers. Visit www.isee.org/ for the society's newsletter *Explosives Industry News*.

Munitions Safety Information Analysis Center, MSIAC. Visit http://www.msiac.nato.int.

China

Tsinghua-Princeton-CI Summer School on Combustion will be held from July 14 to July 20, 2019, at Tsinghua University, Beijing, China. This will be the eighth session of the annual Tsinghua-Princeton Summer School series, following the past seven highly successful sessions each of which was attended by over 300 participants from China and abroad. For this session, we are fortunate and honored to have four world-renowned researchers to contribute the following lectures:

1. Structure and Dynamics of Combustion Waves
   - Professor Paul Clavin, Aix-Marseille Université, France
2. Nonsteady Combustion Physics in Flows
   - Professor Vigor Yang, Georgia Institute of Technology, USA
3. Advanced Laser Diagnostics in Turbulent Combustion
   - Professor Andreas Dreizler, Technische Universität Darmstadt, Germany
4. Combustion Chemistry
   - Professor Philippe Dagaut, CNRS-INSIS, France

Detailed description of the program can be found on
http://www.cce.tsinghua.edu.cn/list.php?catid=225&page=1